3 books in one

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HOW TO MAKE GOOD PRINTS

A Description of the Popular Contact Processes

TWELFTH THOUSAND
WHOLLY REWRITTEN

PRICE, TEN CENTS

American Photography
Handbook No. 7

American Photographic Publishing Co.
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POPULAR PRINTING PROCESSES

Importance of the Print.— The words photograph and print are synonymous. The print is the end and aim of photography. By it your success or failure is judged, for the negative is simply an intermediate step, and a poor negative may be made to yield a good print by careful handling. The amateur who studies the different sorts of printing paper and learns their possibilities is in a position to make far better pictures than his careless brother who uses one printing medium for all his negatives. For instance, a marine may show to the best advantage on blueprint paper; a snow scene, on smooth platinum in clean bluish-black; a woodland view, on Velvet Green; and an autumn landscape on redeveloped gaslight or bromide paper in a beautiful warm sepia color. Again, a faulty negative, incapable of making a good printing-out paper proof, may produce a very satisfactory effect on one of the three grades of contrast in which gaslight papers are generally furnished. If only one sort of paper is used, the worker is obliged to attempt to make all

his negatives to fit the qualities of that paper; but as negatives vary, in spite of all our care, some will fail to print well on the one grade, and others must be resorted to.

Degrees of Contrast.— Some papers tend to reduce the contrasts of the negative, others to increase them. A hard negative succeeds well with one class and fails with the other, and vice versa. There is, however, a happy medium. A plate fully exposed and fully developed can be printed on almost any paper if the time of printing is correct. Beginners generally prefer a print which is brilliant rather than harmonious; but as their taste becomes educated, they avoid heavy, black, detail-less shadows and staring highlights and learn to print on softer papers so as to represent nature more as she looks to the eye.

Preparing the Negative.— The first step in printing is to go over the negatives and correct any blemishes. Films and plates alike may need cleaning, for the wash-water generally leaves a film of dirt on them. Wiping the back of the film with a soft, dry cloth is sufficient. Glass plates should be cleaned and polished with Bon Ami or some other non-scratching scouring soap, or a mixture of alcohol and ammonia. An ounce each of 95 per cent alcohol and stronger ammonia water with two ounces of water is an efficient cleanser. It quickly removes traces of emulsion, which sometimes get on the back during the coating process.

Spotting.— The cleaned negative should now be laid face upward on a sheet of ground glass and examined by reflected light. A cheap retouching frame is convenient, but one can readily be improvised from a mirror and a sheet of ground glass supported by books at an angle of 45 degrees. Take a fine red sable spotting brush and some spotting colors and fill any transparent spots by touching the almost dry brush to them. A little practice soon teaches the knack; and, with care, the spot may be filled in so that little spotting of the print will be needed. Larger defects can be filled in with repeated touches of the brush. Highlights which are too dense can be rubbed down with a bit of chamois leather moistened with alcohol. Retouching is fully treated in the first Handbook of this series, "Retouching for Amateurs." The more time you spend in smoothing out defects, the easier it becomes to make good prints.

Cleanliness.— Cleanliness throughout is what makes the difference between good and bad photographic work. Trays, graduates, etc., should be rinsed both before and after use. At frequent intervals, remove traces of chemicals, stain, etc., by letting acid bichromate solution stand in them for a short time and then washing thoroughly. An ounce of potassium bichromate dissolved in a pint of water and acidified with strong sulphuric acid should be kept in a safe place ready for use. It keeps indefinitely and can be used over and over.

Stamped steel trays enameled white or **white porcelain** trays are easiest to keep clean, as they show dirt at once.

Care of the Hands.— The hands should be washed with soap and warm water before beginning work, taking pains to rinse off all traces of soap. Do not use soap in the darkroom, however, as it may get into the utensils and cause trouble. If the skin is liable to irritation from chemicals, rub a little lanoline thoroughly into the fingers and wipe off surface grease before beginning work.

Light for Printing.— Daylight is too uncertain in its strength to be quite practical for printing. Sudden changes in intensity may take place without being noticed by the eye until the loss of a print shows that the light has altered. It is far better always to use artificial light. The form of the light is, of course, governed by circumstances. An oil lamp is good, but slow; and many workers are so situated that they must depend on oil. The open gas flame is out of date, the Welsbach burner being far more powerful and in all cases to be preferred. Mazda bulbs are excellent when electric current is available. The electric arc is sometimes used, but there are many objections to it, not the least of which is its flicker.

A far more practical light of the utmost power is the Cooper Hewitt. This familiar blue-green light is photographically most valuable, as its rays affect sensitive materials very strongly and it is therefore

extremely fast. For instance, an unscreened tube prints in ½ second as compared with 5 to 15 seconds for incandescent bulbs. The best way to use a tube is to enclose it in a printing box with ground glass and shutter.

This light is suitable also for printing-out papers of all kinds, including platinotype, satista, P.O.P., and others. In fact, some of the largest producers of prints depend exclusively on this light in preference to daylight, as the cost of installation and current is soon saved by the absence of wasted paper. On a large scale, a Cooper Hewitt Quartz lamp can be utilized to operate a printing cabinet. The steadiness of the light is perhaps its greatest recommendation.

PRINTING-OUT PAPERS

Papers which give a visible image by direct printing are called printing-out papers (P.O.P.) because the picture prints right out in plain sight. They are used in direct sunlight or diffused daylight, as only the strongest artificial lights (arc and Cooper Hewitt) are powerful enough to affect them in a reasonable time. The popular papers of this class are blueprint, gelatine P.O.P., gelatine and collodion self-toning P.O.P., and homemade salted paper. Platinum and satista are semi-printing out, as they give a visible but faint image which has to be developed to reach full strength. It is convenient to consider all of these together before taking up the

developing-out papers (D.O.P.) grouped under the names of gaslight and bromide papers.

Blueprint.— Salts of iron, sensitive to light, are spread on plain paper to give blue prints on a white ground. On exposure under a negative, the originally yellowish-green surface becomes darkened, until finally the deepest shadows present a bronzed appearance. When this stage has been reached, the middle tones and some of the details in the lights are visible, and the print is finished. It is now placed in clean running water, in which it instantly turns a bright blue; but the washing must be continued for twenty minutes to half an hour to insure permanence. The slightest trace of soap is fatal to a blueprint, so the process should not be carried out in a wash-bowl. Washing, drying, and mounting complete the process.

The paper is sold in tin cans or can be cheaply prepared by the user with any good quality of plain paper. The keeping quality is not great. Stale paper yields only dull, foggy prints. Moisture is the greatest enemy of the process. It is important to keep unused paper in the can, removing a sheet at a time when needed.

Negatives.— The type of negative best suited for blueprinting is one which has clear glass shadows without much detail and dense highlights — in other words, the typical snapshot which has been fully developed. Thin, weak negatives will not make satisfactory prints by this process.

Printing.— Underprinted paper washes out weak and light. Overtimed prints are too dark. The best guide to correct printing is not the bronzing of the shadows, which may take place early, but the appearance of the first traces of detail in the highlights.

Making Blue Paper.— A suitable formula for making one's own paper is:

A.—	Ferric-ammonium citrate (green scales)	110 grains
	Water	1 ounce
B.—	Potassium ferricyanide	40 grains
	Water	1 ounce

Mix equal parts and keep in a yellow glass bottle in the dark. Filter just before use. Apply to the paper (pinned to a drawing board) with a tuft of cotton, brushing in both directions until evenly moistened. Dry the paper in the dark and use as soon as bone dry. Brighter blue tones are obtainable by treating the prints with a 2½ per cent solution of alum, a 3 per cent solution of oxalic acid, or a 1 per cent bath of hydrochloric acid. The same formula can be used for sensitizing cloth. Proceed as follows:

Blue Cloth.— Select a good quality of linen, muslin, mercerized cotton, or other suitable white fabric and wash thoroughly to free it from size. When dry, immerse for one minute in the sensitizer, wring out, and hang up to dry.

Toning.— The color of blueprints can be altered, but the results are uncertain and not very permanent. Blue-gray and purple tones are obtained by

treating the print in water containing 10 minims of ammonia water to the pint. As soon as the desired color is reached, bathe in a bath of alum, 120 grains; water, 16 ounces. Finally wash in running water for half an hour. Brown to black tones are secured by bleaching the print in stronger ammonia solution, about 1 ounce to the pint of water, and treated with a saturated solution of gallic acid, in which the image reappears. Wash well and dry between blotters.

Transparencies.— Blue transparencies can be made by using the same sensitizer on a bleached negative. The silver is dissolved out of the gelatine by treating the waste negative with a strong Farmer's reducer.

Water to	4 ounces
Potassium ferricyanide	120 grains
Hypo	120 grains

After the image has wholly vanished, wash the cleared plate for at least two hours in running water and immerse for several minutes in the sensitizer. When dry, the plate is ready for printing under the negative in daylight. Light-struck plates can be cleared in plain hypo and used for this process instead of being wasted.

Owing to their cheapness and the attractive color, blueprints are very popular in spite of their lack of gradation. Good negatives are better suited to a medium which will bring out more differences between the middle tones as one sees them in the negative.

Self-toning P.O.P.— Second only to blueprint in simplicity of working is self-toning paper. It comes in two varieties, gelatine and collodion. Both contain the necessary gold to produce a fine brown or sepia tone when the prints are fixed in a weak hypo bath, with or without a pinch of baking soda. When properly fixed and washed, these papers are permanent.

Self-toning papers are sold in a large variety of surfaces both single and double weight, and postcards. The lighter stock sometimes causes trouble by curling, particularly with collodion papers.

Printing.— The paper is printed with the coated side in contact with the dull side of the negative in direct sunlight or diffused daylight until it is one or two shades darker than required in the finished print. A negative fully exposed and fully developed is most suitable. The negative must be perfectly clean and free from dust. The paper may be dusted, but if it is taken from the package by its edges and shaken, with extreme care not to touch its coated side, dusting with a brush is better omitted. To secure sharp contact, it is well to use a felt pad or a sheet of rubber cloth backed with pieces of newspaper to supplement the springs of the printing frame. In humid weather, dry the felt pad in the oven before using.

If the print must show the full size of the negative, use a frame at least one size larger and provide it with a stout sheet of clear glass. Center the nega-

tive on the larger sheet and thus avoid the shading of the edges which may take place in a small frame. Put the frame out to print where no shadow from branches, etc., can fall on it at any time during the printing. There is a superstition that thin negatives should be printed in the shade but facing the sky; but this is not at all necessary if printing is not overdone. Another old idea was to print under ground glass or several thicknesses of the special onion-skin tissue paper sold by photographic supply dealers. The truth seems to be that these precautions simply help the operator to get his prints off in time when handling a large number of frames at once. If, however, greater contrast is required, it can be secured by fitting the frame with a sheet of green glass. Signal green or cathedral green are two of the suitable colors. In the same way, a harsh negative can be made to yield a softer print by using blue glass.

Examining.— As the prints gain in strength, open half of the frame in dull daylight well away from the window and examine the print. It takes only a few minutes in good light to get a "pretty" picture from an average negative. This is called the proof stage, as it is then that professional photographers take off their proofs (and, incidentally, put their fingers on them to cause marks and prevent dishonest amateurs from trying to tone and keep their proofs); but it is not dark enough for toning. Fasten the back and continue printing until the

whole image looks decidedly dark. As the prints come off, they should be stored face to face in a spare box until all are ready for toning. They may even be kept overnight, but most workers prefer to tone at once.

Flattening.— Collodion papers may need to be flattened by immersing them one by one face down in a smooth-bottomed tray containing a very little water. As soon as all are in, drain off the water and let the tray stand in a slanting position for ten minutes before toning. Some makes of paper require several changes of clear water or a salt bath to remove free silver; but most self-toning papers can be put directly into a bath composed as follows:

Water to make	20 ounces
Hypo	2 ounces
Temperature for use	60 to 70 degrees

A pinch of baking soda added to this bath will prevent sulphur toning.

Fixing.— The fixer should be used in a large tray, for instance, a 5 x 8 tray for 4 x 5 prints. Use enough hypo to fill the tray to a depth of half an inch. Take a print and immerse it face down, turning it over immediately to insure even action. Now immerse the second print and bring it into contact with the first, **back to back.** Continue in this way until all the prints are in, and then handle them in pairs by their edges, keeping them constantly on the move during the whole time of toning. If they are allowed to mat together, stains and streaks are sure

to result, either at the time or later. To insure permanency, it is best to allow only half a dozen 4 x 5 prints or their equivalent to each ounce of dry hypo. The time of toning is generally about ten minutes at the temperatures mentioned above.

Dodging.— The control of the color or tone with this kind of paper is very limited. As a rule, thin, quick-printing negatives do not give so rich a sepia as slightly more contrasty ones. The user, notwithstanding, is cautioned not to conceive an exaggerated idea of the contrast needed in the negative. Overdeveloped negatives may need to be printed with tissue pasted over the frame and worked on with powdered Prussian blue to hold back the shadows or turpentine to make the paper translucent over the dense highlights. Shadows can also be held back by working on the glass of the negative with a negative-marking pencil or flowing the plate with ground-glass substitute, plain or tinted, and scraping it away from the portions one wishes to print more deeply. An expert professional printer, by taking advantage of all these and other dodges, can turn out splendid prints from very faulty negatives. The amateur is reminded that such means of improving his results are most easily carried out with printing-out papers, as their effect can be watched. Local shading during printing can easily be effected by tearing a piece of cardboard roughly to the desired shape and tacking it to the frame. Raise the free edge about an inch from the negative

to avoid printing a sharp line and put the frame out in the shade. After a few trials, one becomes expert in this sort of work and can modify results in an astonishing manner without running the risk of spoiling the negative by attempting intensification or reduction.

Blue Tones.— Colder tones, tending to blue, can be had on self-toning paper by printing more deeply and giving the prints a preliminary bath of common salt, say a heaping teaspoonful to a pint of water. Strong negatives are needed. Self-toning paper, however, does not require quite so brilliant or "plucky" a negative as the old variety of P.O.P.

Washing.— Washing of the prints should be performed by transferring them one by one from tray to tray of clear water, allowing twelve five-minute changes. If the prints are washed in running water, make sure that it does not strike the prints forcibly, or it will blister them. Temperature is very important, even in washing, and all manipulations should, if possible, take place between 60 and 70 degrees at all seasons.

Drying.— The washed prints should be dried face up on clean blotters. Collodion prints can be dried between blotters or even over a source of heat, but gelatine papers cannot stand such treatment.

Ferrotyping.— Glossy prints are given a very high polish by the use of squeegee or ferrotype plates. It is essential to dry the prints and rewet before squeegeeing, or they may stick to the plates. The

plates are coated with a japan or enamel and should be well washed and then rubbed over with a solution of beeswax or paraffin wax in benzol or turpentine. A few drops are sprinkled on, rubbed all around with a soft cloth free from lint, and the final polish given with a silk cloth or chamois leather. A good formula is:

Beeswax	20 grains
Turpentine	1 ounce

When the plates are ready, immerse them in water and bring the prints into contact with them under water. Remove together, and squeegee the print into contact, using a flat rubber squeegee from the center toward the corners. Set the plates in a moderately warm place to dry. Do not attempt to strip off the prints until bone dry, or they will surely stick and tear. The tip of a penknife blade inserted under one corner will cause the print to spring off when it is quite dry. The chief cause of prints sticking is failure to dry them and rewet before putting them on the plates.

Matt Prints.— Prints can be given a matt surface by squeegeeing to ground glass, of course without any wax. As, however, matt and even rough and linen-surfaced papers are now furnished in self-toning brands, such a course is seldom necessary.

Mounting.— Squeegeed prints must be mounted dry, using dry mounting tissue, a gelatine mountant, or hinge tape.

Wet mounting is carried on in the usual way. Stack all the prints on a sheet of glass. Brush over the top one with a good paste on a rubberset bristle brush. Lift the print, turn it over, and lower it into place on the mount, holding it in a U shape so that the middle comes into contact first and lowering the ends so that air will be expelled. Success in making the print stick will be easy if the paste has been worked into the print until it becomes tacky and makes the brush drag and the edges and corners are well pasted. When the print is correctly placed on the mount — an Ingento Centering Square is invaluable here — lay a piece of clean lintless photographic blotter on it and roll with a good roller squeegee.

Curling.— To prevent curling of the mount, paste a piece of paper the same size on the back of the mount. Another way is to dry the mounted prints under pressure.

Prints can be mounted on cheesecloth by pasting them while on the ferrotype plates and rubbing the cloth into contact, leaving both until dry. In this case, they should not be trimmed until after mounting. Single-weight paper can also be backed with a sheet of the same weight prepared for the purpose under the name of backing paper. The coating of the second sheet counteracts the curl of the first. Double-weight paper, however, will stay flat enough without such precautions.

P.O.P.— The older form of printing-out paper contained no gold, but had to be washed, toned in an alkaline gold bath, and fixed separately. A modification of the process, a "combined" toning and fixing bath, may be mentioned only to condemn it. Prints put through such a treatment almost invariably fade in a short time.

Stock Solutions.— Precise directions are given with each make of P.O.P., yet all will work satisfactorily if the following plan is adopted, as toning can take place even in artificial light. The solutions required are a 10 per cent solution of ammonium sulphocyanide, a 10 per cent solution of common salt, a 10 per cent solution of hypo, and a gold bath containing 1 grain of gold chloride in each dram of water. The principle is to use a definite weight of gold for a given number of square inches of paper and to leave the prints in the bath until all of the gold has been used up.

Toning Bath.— The toning bath is made up as follows:— Measure out 10 ounces of water and add 2 drams of sulphocyanide solution and 1 ounce of salt solution. Mix, and add 1 dram of the solution of gold chloride. Label the bottle "Gold Toning Bath." Each ounce of this bath contains 1-10 grain of gold, which is sufficient for two 3¼ x 4¼ prints. For warm brown tones, half to three quarters of an ounce is enough; for blue tones, a little more may be needed. Other sizes may be readily handled by taking more or less bath for each print.

Toning.— Now suppose that you have ten 3¼ x 4¼ prints to tone. Measure out five ounces of toning bath and put the prints directly into it without previous washing, handling them in pairs back to back. Continue to handle them in the bath until no further change of color can be seen. The final stage is when the surface looks cold and slaty-blue.

Finishing.— Washing, fixing, and finishing are the same as already described for self-toning paper. Eight to ten minutes is ample time for fixing, and the prints should not be left lying in the hypo any longer or they will bleach.

The advantage of this method is that one can always duplicate a desired tone if notes are kept of the exact amount of toning bath used for a print of a certain size to produce a given color.

Instantaneous Toning.— Another certain method of securing uniform tones is the so-called instantaneous toning bath. Four stock solutions are needed.

A.— Ammonium sulphocyanide	1 ounce
Water to make	10 ounces
B.— Gold chloride	15 grains
Water to make	7½ ounces
C.— Sodium phosphate	1 ounce
Water to make	10 ounces
D.— Saturated solution of borax.	

Mix, for toning ten 4 x 5 prints:

A	1 dram
Water	8 drams
B	4 drams
C	1 dram
D	2 drams

The prints, which should be only one shade darker than desired, are put directly into the toning bath without previous washing. On entering the bath, the prints turn red, but within half a minute they assume a beautiful dark purple tone, almost black in the deepest shadows. No matter how much longer they are left in, they will not change again. As soon as the prints have assumed a uniform color, they may be fixed, or, if preferred, transferred to a tray of clear water until the entire batch is ready for fixing.

Brush Toning.— This method of toning, like the preceding, uses up every particle of gold in the bath. It is therefore highly important to measure out the right quantity for the number of prints to be toned. For instance, to tone four 4 x 5 or two 5 x 7 prints, measure out 15 minims of sulphocyanide, 120 minims of water, 60 minims of gold, and so on. To use such a small quantity to the best advantage, it is a good plan to lay the print face up on a clean sheet of glass and brush the toner over it with a tuft of cotton or a rubberset camel's hair brush, letting the surplus drip into a graduate. No matter how streaky the prints look at first, if the brushing is continued they will tone evenly and stop. Apparently they quickly absorb all the gold they are capable of taking up and thereby reach a very high degree of permanency. Prints toned in this manner have been exposed, half covered, to direct sunlight for three months without showing any dividing line.

Keeping Quality.— The stock solutions keep indefinitely, particularly if made up with distilled water and stored in yellow glass bottles in a cool, dark place. The mixed bath will not keep more than an hour.

Economy.— Users of this method can easily calculate the exact quantity of each stock required for

toning a print of a given size, check the figures by trial, and draw up a table showing how much to take for any number of prints. No gold is wasted, so it is extremely economical. It is simpler than other methods, as it requires no judgment. Still, if the P.O.P. worker prefers, he can follow the plan of using a bath of the strength advised by the maker of the paper and toning until the print has a particular color when looked through toward a window. The objection to this way is that prints are seldom uniform, as the strength of the light has a great deal to do with one's estimate of color. The instantaneous method can be worked at night. For instance, one can print in the morning before going to business, store the prints in a light-tight box, and finish them in the evening.

Many readers of *American Photography* have written to the Editor that they have tried the instantaneous toner and found it to work perfectly. Beginners are earnestly advised to do their toning by one or the other of the two methods just given until they become expert. Then, if they desire to secure other tones, they can experiment with different toning formulas, but we hope that no one will be unwise enough to use the combined toning and fixing bath and expect the prints to last. Remember that P.O.P. is permanent only if fixed as directed and then washed until the last trace of hypo is removed.

Homemade Silver Papers.— The amateur can sensitize pure paper of good quality, either rough or smooth, by "salting" it and afterward sensitizing it by floating on a solution of silver nitrate. Any of the drawing papers sold by dealers in artists' materials is satisfactory. A simple salting bath is:

Ammonium chloride	100 grains
Gelatine	10 grains
Water to	10 ounces

Swell the gelatine in a little cold water and dissolve it by warming gently in a water bath. Then add the chloride and make up to the required volume. The solution must be filtered into a chemically clean porcelain tray and the paper floated on it for three minutes, then dried in a warm, dark room while suspended by a clip from a line. The knack of floating the paper so as to avoid air bubbles is easily acquired if one holds the sheet in a U shape and lowers the loop until it touches, afterward lowering first one and then the other limb of the U.

Sensitizing.— The dried salted paper keeps indefinitely. When some is required for use, it is floated for a minute or two (depending on the roughness of the paper) on a bath containing 45 grains of chemically pure silver nitrate to each ounce of distilled water. Drying should be rapid, say overnight in a warm, dark room.

Printing.— The paper is printed in the same manner as bought P.O.P., only somewhat deeper, as the image tends to "sink in" on account of there being no waterproof coating under the sensitive layer.

Toning.— Toning for warm sepias is in a gold bath. Blacker tones can be obtained in a platinum bath, as follows:

Potassium chlorplatinite	4½ grains
Water	10 ounces
Nitric acid	2 to 3 drops

Albumen Paper.— The old-fashioned glossy albumenized paper can be obtained from some large dealers and sensitized by the user. Lately there has been a revival of interest in this old process, and several manufacturers have placed on the market ready sensitized matt albumen papers. Those who are interested can obtain information from their dealer. Albumen is undoubtedly more permanent than gelatine P.O.P., when properly handled, as

the many bright prints dating from Civil War times show.

Platinum Paper.— The high cost of platinum naturally prevents a popular use of this printing medium, yet it is one of the most beautiful of all processes and the image is more permanent than the paper on which it is supported. The color is a clear, beautiful blue-black to warm black. The paper has no gloss, hence the effect is just as artistic as a drawing in pencil or charcoal. Although the worker can make his own platinum paper, it costs him two or three times as much as it does to buy it ready for use.

Platinum paper is sold in tin cans containing a lump of preservative, which is necessary to prevent the paper from absorbing moisture and spoiling. When fresh, the paper is bright yellow on the sensitive side. It is printed in daylight, with every precaution to exclude moisture, preferably by means of a sheet of rubber cloth behind the paper.

Printing.— As the paper is extremely rapid, progress must be noted at frequent intervals. The paper must be examined in very weak daylight. The image appears gray on a yellow ground. After a few trials, it is easy to judge correct printing. The first traces of detail should just begin to show faintly under the denser portions of the negative, which is preferably rather bright though not extremely contrasty. An amount of clearness of the shadows which would be too much on the clear-glass order for most papers is not objectionable for platinum printing. A negative with foggy or veiled shadows is not at all suitable. Full exposure and full development are the requisites. From such a negative, platinum will yield a print the delicate gradations of which cannot be surpassed by any printing process whatsoever.

Developing and Clearing.— The finished print is put directly into a strong bath of potassium oxalate, in which the image at once flashes up full strength, though it does no harm to leave the print in for a longer time. From the developer, it is transferred to an acid bath, 1 ounce of chemically pure hydrochloric acid to 60 ounces of water. In this it remains five minutes, going afterward into two fresh acid baths for the same period. A short wash in running water completes the process.

Sepia Paper.— Platinum paper is also made in sepia, generally developed in a hot bath, though cold-bath sepia papers are obtainable. Of late years, the demand has been for warm tones, so the characteristic blue-black is harder to obtain. Papers of harder surface are also furnished under the name of Japine.

Satista.— The inventor of platinotype, Mr. Willis, has lately brought out a paper of the platinum class containing this metal and silver. The price is only about a third that of the regular platinum paper and the results can hardly be distinguished from it except by chemical tests. The tones obtainable are black, warm black, and sepia. The paper stock, like platinotype, is free from emulsion, so that it gives the same refined, artistic effects.

Rapidity of Printing.— Satista is extremely rapid, about five times as fast as P.O.P., and in bright light one can attend to only two to four frames at a time. The image appears gray on a yellow ground. Printing is done when shadows and middle tones have made their appearance. Overprinting gives dark, muddy prints. The paper is not very sensitive to damp, so it can be stored after printing if it is not convenient to finish the operations at once.

Developing.— Development takes place in the following bath:

Hot water	32 ounces
Potassium oxalate	8 ounces
Oxalic acid	100 grains

To be used at not less than 60 degrees Fahrenheit. The image flashes up to full strength, but the print should not be taken out until 30 seconds have elapsed. Then it is plunged at once into a clearing bath.

Clearing.—

Warm water	80 ounces
Potassium binoxalate (salts of sorrel)	1½ ounces

Two ten-minute changes of this are needed, the prints being moved around several times in each bath. The second bath should remain colorless; if it yellows, use a fresh portion.

Rinsing.— After the clearing the prints should be washed in running water for not less than eight nor more than ten minutes. The correct time is extremely important, as too brief a washing will not remove the clearing salt and too prolonged action may produce stain.

Fixing.— The silver remaining in the paper has now to be removed by fixing in a 10 per cent plain hypo for about 15 minutes. It is important to keep the prints moving to insure even action.

Washing.— The final washing should take not less than 40 minutes in running water, again seeing that the prints are kept well separated.

As satista has no gelatine or collodion emulsion, it dries flat and stays flat. Its high permanency, low price, and high artistic quality should make it one of the most popular of all processes among those who have time for daylight printing.

DEVELOPING-OUT PAPERS

In marked contrast to the papers already spoken of is the class of developing-out papers (D.O.P.). It includes "gaslight" and bromide papers. The line dividing these kinds is not very definite, as some papers may be called either a fast gaslight or a slow bromide variety. The chief distinction is in speed. Bromide papers are of almost as great speed as the very slowest plates. White light of any kind spoils them instantly; but orange light is perfectly safe. Any source of artificial light can be used in the darkroom if orange fabric or postoffice paper is used and the least trace of white light is excluded. The light should be tested for safety in the same way one would test a ruby light for plates, that is, by exposing a piece of the dry paper half covered with black paper for about two minutes in the place where developing is usually done. Two minutes' development should not cause any darkening of the exposed portion, if the developer contains enough bromide to prevent fog, so if it darkens, use another thickness of orange fabric or postoffice paper over the light. Other points which distinguish a true bromide paper are its wide range of tones from a pure but not heavy black to a clear white — in other words, its great range of gradations—the relatively weak developer required, and the slowness of development. A properly timed image appears in 45 seconds to 1 minute and is not completely developed until two minutes have elapsed.

Characteristics of Gaslight Papers.— Gaslight papers, though some of them must be handled in orange light to prevent fogging or lead-colored whites, develop much more rapidly than bromide paper, and most of them have a much shorter range

of gradation, with a more solid black in the deep shadows. They come in several grades of contrast, making them suitable for all types of negatives. Contrast papers are suited to thin negatives — too thin to print on anything else; normal papers, to good negatives of average contrast; soft papers, to the more brilliant, contrasty negatives which yield the best prints on P.O.P. By using the different grades, the worker can make his prints as brilliant or as harmonious as he chooses.

Most gaslight papers can be printed by any strong artificial light and developed at a distance of eight or ten feet from the same light. The best plan, however, is to place a screen between the light and the worktable and handle the paper in its shadow except when it is in the frame and being exposed close to the light.

Choosing a Paper.— Any of the advertised makes of gaslight paper will be found reliable if handled exactly as the maker directs. Most are made in three grades, but a few in two only. Each grade is generally offered in a number of surfaces, glossy, semi-matt or velvet, matt, rough, etc. The most generally useful surface for small prints is the velvet, which has a slight but not unpleasant sheen and brings out almost as much detail as the glossy or enameled surface. Procure the contrast or hard grade for your thin negatives which have not sufficient contrast between the highlights and the shadows (underexposed and underdeveloped); the normal for good average negatives, and the soft for hard, contrasty (overdeveloped) negatives.

Opening the Paper.— Daylight or strong artificial light must not be allowed to fall on the surface of the paper until it is exposed behind the negative. Open the paper in the shadow of your screen (unless orange light is used). It will be found wrapped in black paper. The coating has a tendency to pull

the paper into a curve, with the emulsion on the concave side; but in case of doubt you can tell at once by biting a corner between your teeth, which will stick slightly to the gelatine coating. This is the only infallible test. Avoid touching the surface with the fingers.

Loading.— The negative is put into the frame dull side upward and the emulsion side of the paper put down upon it. The paper may be dusted before putting it into the frame to prevent white spots. Fasten the back of the frame and expose.

Exposing.— The time of exposure must be found by experiment. Hold the frame directly opposite the light at a distance equal to the diagonal of the negative, that is, about 7 inches for a 4 x 5, 10 for a 5 x 7, etc. If the frame is brought too close to the light, the middle of the picture will receive more exposure than the edges and come out too dark as compared with the corners. It is advisable always to print at exactly the same distance from the light. A handy wrinkle is to tie a string to the light fixture and tie a knot in it at the right distance. Then the string can be pulled taut and the frame brought up to the knot. Other plans will suggest themselves to the reader to suit his own arrangement of apparatus. The importance of uniform distance is evident when one remembers that an exposure made at double the distance takes not twice but four times as long; the law is, exposure varies as the square of the distance.

Guide to Exposure.— The best guide to correct exposure is found in the direction sheet which comes with the paper. The maker states the correct time of development for his formula at ordinary temperatures. Thus, a certain make may need 15 seconds, another 45 seconds; but, whatever the time, a proper exposure will reach full strength in that time and pause without growing darker. If, now, the print

is too hard or too soft to suit, the only way to get a better result is to choose a different grade of paper for the next trial. In any case, *read every word of the direction sheet several times before beginning work.* A sheet of paper cut into strips and used for finding the best exposure is the truest economy.

Developing.— The exposed paper is taken from the frame and immersed face upward in the developer. Have the solution about half an inch deep in the tray, hold the paper slanting, plunge one edge into the developer and push the sheet under, at once turning it over and back to break up any air bubbles — but if the procedure is properly carried out there will not be any. The image soon appears on the surface and rapidly darkens until it is strong enough. An underexposed sheet will not reach full strength in the right time and had better be thrown away, as if left in too long it will stain yellow all over or begin to turn gray in the whites. The latitude, or permissible variation of exposure, is very small with gaslight papers. Overtimed paper develops quickly and blackens too much. If the developer contains too much bromide the print will have a sickly greenish or brownish tone, no matter how quickly one snatches it out. Success, therefore, depends on getting the exposure exactly right.

Rinsing.— The moment the print has become dark enough, it must be taken from the developer and rinsed either in plain water or weak acid. In the latter case, if the room is lighted with a safe orange illumination, the print may remain in the acid until a number have accumulated, as the developer is "killed" by the acid. If the light is not orange, remove the print at once to the acid fixing bath. A short rinse, just enough to remove most of the alkaline developer, is all that is needed.

Fixing.— D.O.P. should invariably be fixed in a fresh, strong acid hypo. The acid fixers sold for

paper are reliable, or the user can mix his own from the formula in the direction sheet. Good, permanent prints can be made only by using a fresh bath for each lot of prints. The print should be submerged at once and completely. A glass filter funnel, stem up, is handy; or a stick can be used. Avoid putting your fingers into the hypo, and, in any case, rinse them in clear water and dry them on a clean towel before touching another sheet of paper. The slightest trace of hypo spattered or carried into the developer will produce spots and stains. Every time you put another print into the hypo, move the others around with the stick. Don't let them float up to the surface. After the first print has been in for ten minutes, turn all face down and continue putting prints in face up for another ten minutes. Then remove the first lot to a tray of clear water. Too long fixing may lead to a brownish tone in the middle tints of the print unless the bath is kept cold with ice. Some makers say that ten minutes is long enough for single-weight and twenty minutes for double-weight paper; but the time given will be found satisfactory.

Working in orange light and using the acid short stop (one ounce of acetic acid to the quart of water; frequently renewed, if many prints are making), one can leave the fixing to be done at the end of the printing. This is a good plan, as one can keep the prints moving and separated thoroughly for ten to twenty minutes and is then sure that they will be completely and evenly fixed.

Washing.— Complete removal of hypo is essential if the prints are to remain unaltered for a reasonable time. A picture on D.O.P. should be as permanent as a negative. A troublesome but effective way is to give twelve five-minute changes in two trays. Any method of washing, to be effective, must keep the prints well separated and not let

them lie at the bottom of the dish in a pool of hypo solution which has washed out and settled. There are several very good automatic washers on the market. The writer uses two Ingento washers of different sizes and finds that they do the work of eliminating hypo in half an hour. The washer must be large enough to allow the prints to revolve freely all the time. One designed for 4 x 5 prints will not work well with 4 x 6 paper, for example. If the family washbowl is the only utensil available for use with running water, take out the prints every ten minutes, drain the bowl, and refill; also keep handling them over all the time. A piece of stout rubber tubing attached to the faucet, stoppered at the other end, and pierced with holes, can often be adjusted so as to keep the prints moving and separated. The same idea can be applied to a tray or a tank.

Hypo Test.— The test for elimination of hypo is as follows:

Potassium permanganate	2 grains
Potassium carbonate	20 grains
Distilled water to	40 ounces

Take a little of this solution in a clean graduate and hold the prints so that they will drip into it. If the pink color is discharged and replaced by a greenish-yellow or a brown coloration, hypo is present, and the washing should be continued until the drippings no longer cause any alteration in the permanganate solution.

Cleaning.— When the prints come from the washing water, dirt will invariably be found on them. Stack them face up on a sheet of glass and clean them one by one with a tuft of absorbent cotton. You will be surprised to see how much dirt there is on them.

Drying.— Well-hardened prints can be dried between blotters under pressure in a hot place. A roll is best. Procure a large pasteboard mailing tube and wind good lintless photographic blotting paper around it, laying the prints face up. This of course makes them curl inward; but, on being removed from the roll, they will lie flat when they are thoroughly dry.

A simpler method of drying is to lay the cleaned prints face down on cheesecloth stretchers. They will curl somewhat when dry, and should then be evenly moistened on the backs and placed between blotters under pressure until quite dry.

Straightening.— Curled prints can be straightened when dry by laying them on any hard, smooth surface and drawing them gently under a straight edge. If they are given a marked curl in the wrong direction, they straighten out nicely on being put under pressure for a short time.

Finishing.— The mounting of D.O.P. is carried out just as with gelatine P.O.P. The glossy kind can be squeegeed in the same manner on ferrotype plates.

Defects, such as white spots, are easily touched out with a fine sable brush and a set of spotting colors.

Redevelopment.— The image of a black-and-white gaslight print consists of pure metallic silver in gelatine. The picture can be turned into a beautiful sepia by converting the silver to silver sulphide. The process consists of two steps, bleaching and redeveloping.

Bleaching.— The bleaching formula is:

Potassium ferricyanide	100 grains
Potassium bromide	100 grains
Water to	10 ounces

The well-washed black print is put into this bath

and left until all traces of black have disappeared from the deepest shadows.

Redeveloping.— The print is then rinsed and put into the sulphide bath, in which the image redevelops to a rich sepia.

Hot water	15 ounces
Sodium sulphide (not sulphite)	3 ounces

Boil ten minutes, filter, and add

Water to	25 ounces

To redevelop, take 1 ounce of this stock to from 12 to 20 ounces of water. Finally wash well.

Redevelopment should never be done in a room where sensitive materials are kept, as the sulphide fumes will spoil plates and papers very quickly.

Hypo-Alum Toning.— A method of sepia toning which gives purplish-brown tones is to treat the black prints in a bath containing precipitated sulphur. Used cold, it tones in several hours; used hot, in a few minutes. A suitable formula is:

Hypo	5 ounces
Powdered alum	1 ounce
Boiling water	70 ounces

This bath is milky and must not be filtered. It should be "ripened" by putting in a few spoiled prints or adding a few grains of silver nitrate and common salt. The older it gets, the better it works, if kept up to the original bulk by adding water and fresh bath from time to time.

Control of Contrast.— Both of these toning processes reduce the contrast of the prints, so they are best fitted to pictures of considerable vigor. A soft, well-balanced black-and-white picture seldom looks well when redeveloped.

Control of Color.— The color of the original print controls the shade of the resulting sepia. For sul-

phide toning, use as little bromide as possible — just enough to hold the highlights clear and give a blue-black deposit. For hypo-alum, use more of bromide, as a warm-black original gives the finest tone.

There are, naturally, many modifications of these formulas issued by different makers to suit their own papers; but the reader will find them fully covered in the manuals which they furnish on request to users of their goods. Space will not permit treating them here.

Bromide Printing.— Although bromide paper is used mostly for enlarging, it can be used for contact printing in much the same manner as gaslight paper. It needs rather a stronger negative. In fact, a good print can often be turned out on bromide from a negative too hard for any grade of gaslight paper.

Exposing.— The exposure for bromide paper is very short. One or two matches burned about three feet from the frame is often sufficient illumination for an average negative.

Developing.— The developer is used only about half as strong as for gaslight paper. The image appears in about a minute and is not completely developed in the lights until another minute has passed. As the paper tends to softness, brilliant results can be obtained only by giving short exposure and using the normal developer. Soft, gray prints, with a lovely pearly quality, are secured by overexposing about four times and developing with double or triple the usual amount of water and plenty of bromide. In other respects, it is handled just like gaslight paper.

Metol-Hydrochinon.— Makers' formulas are always safe, for some papers need a very strong bath and others would be spoiled unless they were treated in a weaker solution. A good average formula has been given by E. J. Wall.

Metol	25 grains
Sodium sulphite, anhydrous	350 grains
Sodium carbonate, dry granular	260 grains
Hydrochinon	36 grains
Water	16 ounces

This can be used for negatives by diluting with an equal quantity of water. For papers, take 1 part of solution, 3 parts of water, and add 10 minims of potassium bromide 10 per cent solution for each 8 ounces of diluted developer.

Bromide Solution.— A 10 per cent solution of bromide is:

Potassium bromide	48 grains
Water to	1 ounce

Each minim (drop) contains $\frac{1}{10}$ grain. A saturated (65 per cent) solution is:

Potassium bromide	312 grains
Water to	1 ounce

Each minim contains 0.65 grain.

Amidol for Gaslight Paper.— The writer has tried many formulas and prefers the following where rich, blue-black prints are desired. Overexposure gives disagreeable greenish tones. The developer must be prepared at the time of use.

Water to make	10 ounces
Sodium sulphite, anhydrous	250 grains
Amidol	50 grains
Potassium bromide	2 grains

Use full strength for hard-working papers. Dilute with an equal volume of water for soft-working papers.

Amidol for Bromide Papers.— Strong, rich prints on bromide papers can be obtained with the following:

Water to make	20 ounces
Sodium sulphite, anhydrous	325 grains
Amidol	50 grains
Potassium bromide	10 grains

The same formula, with more water, yields pure black to gray prints.

A Universal Developer.— The writer has worked out the following two-solution duratol-hydrochinon for general use on films, plates, and all kinds of D.O.P.

A.— Water to make	32 ounces
Potassium metabisulphite	60 grains
Dissolve and add	
Duratol	30 grains
Hydrochinon	90 grains
B.— Water to make	32 ounces
Sodium sulphite, anhydrous	1½ ounces
Sodium carbonate, dry granular	2 ounces

For gaslight papers and films, equal parts of A and B, with bromide only if necessary to keep the whites clear.

For plates and bromide paper, 1 A, 1 B, 2 water.

For tank development, 16 to 24 minutes at 65 degrees Fahrenheit, 1 A, 1 B, 4 water.

The proportions of this developer are properly balanced and should not be altered except to use more or less water. It gives good results at all temperatures from 40 to 80, and has some very definite advantages possessed by no other combination. Among them are: less tendency to fog or stain, fuller range of gradation, and greater control.

It develops papers slowly and therefore allows more latitude in exposure than the faster-working M.-Q.

Acid Hypo.— One of the best acid hypo baths is the simplest of all. Either potassium metabisulphite or sodium bisulphite can be used as the acid clearer and hardener.

Water (warm)	64 ounces
Hypo	16 ounces

Dissolve and add

Water (cool)	16 ounces
Potassium metabisulphite	1 to 2 ounces

or

Water	16 ounces
Sodium bisulphite, granular	1 to 1½ ounces
(or Lumière's liquid)	2 to 3 ounces

If excessive hardening action is required in hot weather, ½ ounce of powdered potassium alum can be dissolved in the hardener before adding it to the hypo. Chrome alum can be used if preferred.

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PRACTICAL DEVELOPMENT

EVELOPMENT is a subject of intense interest to every amateur photographer who advances far enough into the fascinating pastime of picture-making with the camera to prefer doing it all instead of paying someone to "do the rest." Although the process is a chemical one, little knowledge of chemistry is required, and that little may readily be mastered. Fully to understand development, however, it is essential to review briefly what happens to the plate during exposure.

Action of Light on the Plate.— The image formed by the camera lens falls upon the sensitive surface of the plate or film and impresses it in proportion to the intensity of the light coming from different parts of the subject. Thus, a highlight, such as a white house, acts more strongly than a shadow, such as the shade cast by a tree. If the exposure is correct (see *American Photography Handbook No.* 2, "The Secret of Exposure"), every object will impress the plate just enough to indicate its proportionate lightness or darkness in the scale from black to white

of the final photograph or print. But no visible change takes place in the creamy yellow film. The image is invisibly impressed on the millions of tiny grains of silver bromide imbedded in gelatine. Each one acted upon by light is made capable of being converted into a grain of pure metallic silver, black in this finely divided form. Those unacted upon have not this property. A moment's reflection will show that the blackening of the affected grains will give a negative, that is, an image black where the subject is white, and yellow where it is black. Removal of the yellow portions by "fixing" gives a transparent sort of stencil or printing plate from which any number of positive copies or prints can be made. It is the function of the developer to blacken the affected silver and render the invisible image visible.

The Relation between Exposure and Development.— Almost up to the present time, it has been taught that development could be made to "correct" errors in exposure; but we now know that this is true only to a most limited extent. Unless the image is actually impressed, it cannot be developed; if it is too strongly impressed, it may develop too much. When the photographer insures reasonably correct exposures by the use of a good set of tables (the "American Photography Exposure Tables," price 25 cents, is one of the most popular) or of a meter, development becomes almost automatic. The exposure having determined the relations

between the tones or gradations, development has only to be stopped at the right point to give a good negative. Almost the entire art of development consists in learning when to stop.

Incorrect exposures, known in advance, may sometimes be so handled in a modified developer as to give a different type of negative than could be obtained with regular treatment; but it is a question which each user must settle for himself by experiment whether such tinkering gives any better *prints* than he can secure by normal development and after-treatment with intensifiers or reducers. The writer's opinion is that only subjects of very abnormal character, such as dark interiors with bright windows showing, line drawings, and a few other similar kinds, need any modification of the developer *if the exposure is correctly calculated.* As, however, it is often thought advisable to make all negatives as nearly alike in printing quality as possible, directions for altering the developer to produce any desired modification will be given.

Two Kinds of Developers.— Early photographic processes were carried out with the so-called "physical" developers, which meant those which deposited silver upon the image. They survive in the wet-plate process, which is almost universally employed in process engraving for illustration. The image is formed on the surface of a transparent waterproof film of collodion wet with silver solution, the developer causing metallic silver to adhere to

the film wherever light has acted. A modern developer of this class is the acid Hydra developer sold for Hydra plates, the combination allowing exposures thousands of times in excess of normal.

Modern developers for dryplates are used in alkaline solution and their action is a chemical one which goes on within the thickness of the gelatine film. A complete developer usually consists of water, the developer substance proper (often called the reducing agent), the preservative, the accelerator, and sometimes a restrainer. Let us now take up these

CONSTITUENTS OF THE DEVELOPER

Developing Agents.— All developers belong to the class of chemical substances called reducers. They attack silver bromide (the light-sensitive compound of silver in the film), tear off the bromide, and leave the metallic silver behind. The first which was used is ferrous oxalate, formed by pouring an acidified solution of ferrous sulphate into one of potassium oxalate. The materials are cheap, and the developer is one which may be used when newer agents cannot be obtained if one is able to give about double the exposures needed for the organic developers.

Pyro.— Of this latter class, pyro comes first in point of time and in general esteem. It is made from gallic acid, and its correct designation is pyrogallol, though it is often called pyrogallic acid. It comes in very light fluffy white needles (resublimed) or in large crystals. It is extremely soluble in water.

An acid substance, preferably potassium metabisulphite, must be dissolved in the water first if it is not to be used at once. Pyro is almost always used with sodium sulphite as the preservative (or stain-preventer) and sodium carbonate as the accelerator. The image is a compound of silver and pyro stain. Pyro requires from four to five times its own weight of anhydrous sodium sulphite to prevent stain and give a black image. The developer when mixed ready for use varies in pyro strength from about ½ grain (for tank) to 2 grains or more (for tray) to the fluid ounce. Its behavior can be markedly altered by varying the amounts of water, pyro, sulphite, carbonate, and bromide, hence many users believe that they can "control" their plates by modifying the solution after the image has appeared — something which experiment does not confirm. The truth seems to be that it is just as well to adopt a uniform strength of solution which gives good results and learn to stop development at the right time. Since a developer weak in pyro gives more delicate gradation, known underexposures can be treated from the start in a dilute solution. Since a strong developer (4 grains of pyro to the fluid ounce) with a great deal of bromide added allows the highlights to become dense before the shadow detail is fully out, such a solution is valuable for treating known overexposures, *if used from the start.* It is *not* possible to alter the results after the image has once completely appeared. The great success of the

developing tank in handling incorrect exposures has convinced many that it is better to develop for a fixed time and carry out the modification of incorrect exposures by subsequent intensification or reduction.

Hydrochinon (Quinol).— This developer is derived from carbolic acid (phenol) and was introduced not long after pyro. It comes in fine white needles and has only about one quarter the bulk of resublimed pyro. It keeps well in solution without any other preservative than a sulphite. It is sensitive to cold, ceasing to act at about 50 degrees Fahrenheit, and is used alone only for special work where great density or opacity of the negative is required, generally with caustic soda or potash. In combination with metol — the popular M.-Q.— it is the most widely used developer next to pyro.

Metol.— Metol was introduced soon after hydrochinon. It differs widely from the preceding by its remarkable energy. It causes the entire image to flash up quickly on the surface of the plate, though density follows slowly. Unless restrained with bromide, it will develop even the unaltered silver bromide, causing fog. It gives very soft, delicate negatives when used alone, as most workers do not leave the plate in long enough to acquire the full density. The deposited silver is blue-black in tone and has only a moderate printing-opacity, so that a brilliant looking negative may yield a very flat print. For this reason, it is generally combined with

hydrochinon, with which it unites chemically to form a new developer substance.

Glycin.— The energy of glycin is so low that it has absolutely no fogging action; but the patience of a Job is required to wait for it to complete its work, the user generally giving up in despair and fixing the plate before the shadow details are all out. It is unexcelled for the development of known over-exposures and is used successfully in tank strength for any exposures. It gives a very brilliant, dense negative of black to blue-black color. The writer has always made it a practice to give double the usual exposures when using glycin, hydrochinon, or strong pyro. The combination of metol with glycin increases its working speed greatly.

Other Developers.— There are many other organic developers, the most popular of which are adurol, ortol, edinol, rodinal, duratol, and amidol. Space limitations forbid an extended consideration of all, as they and their combinations are legion. It is, notwithstanding, necessary to speak of two of them.

The first is rodinal, a concentrated solution of paramidophenol hydrochloride with sodium sulphite and caustic lithia. This is a complete developer, requiring only dilution with from 10 to 100 parts of water for use. It gives a soft, gray-black deposit. Owing to its "universal" character and extreme convenience, it is immensely popular. Azol and citol are similar preparations put up by other makers.

The other is amidol (diamidophenol), which is peculiar in that it requires no alkali. It is used with sodium sulphite and bromide, being excessively energetic and inclined to develop unexposed silver bromide unless well restrained. (Note. One ounce — 440 grains — of a first-class anhydrous sodium sulphite gave by test an alkalinity equivalent to 36 grains of dry granular sodium carbonate, from which the reader can see the necessity for using bromide to counteract the alkalinity of the sulphite.) Balagny introduced a formula in which the addition of a small amount of sodium bisulphite (liquid) makes the developer acid in reaction. Amidol is particularly adapted to bromide paper, on which it gives a rich, blue-black color. It is a good developer for plates.

PRESERVATIVES

Sodium Sulphite.— This salt is prepared by passing sulphur dioxide gas into a solution of sodium carbonate, so it invariably has some traces of alkalinity. The crystals are to be shunned. The anhydrous form of the salt keeps perfectly in a tin can or well-corked bottle for years and can always be depended upon. In solution, it oxidizes to sulphate, which has a bad effect on the developer and may cause fog and stain. Solutions containing sulphite should be made up in small quantities to insure their being used within a short time. A stock sulphite solution should *never* be used with amidol.

Acid Preservatives.— Pyro keeps only in an acid solution. Citric, oxalic, sulphuric, and other acids are given in many pyro formulas. The best of all is potassium metabisulphite, a fairly strong acid salt with a sulphurous smell, occurring in large crystals. Of this, 120 grains will keep an ounce of pyro in perfect condition for over a year, by actual trial. Acetone sulphite also belongs in this class. It is acid in reaction and if added to a developer in too great amounts acts as a tremendously energetic restrainer, allowing exposures several thousand times too great. In general, it should be used in one fourth the weight for anhydrous sulphite in any formula.

ACCELERATORS

Sodium Carbonate.— This common alkali, the washing soda of the household, comes in three forms for photographic use, crystals, dry granular, and anhydrous. The second is to be preferred, as it neither takes up nor gives up water on exposure. The crystals lose water and the anhydrous takes up water from the air, both tending to approach the strength of the granular, or monohydrated, which is just double that of pure crystals.

Potassium Carbonate.— Much less commonly used than the soda salt, this preparation is of almost exactly the same strength as the dry granular sodium carbonate, weight for weight. It comes in cans, tightly corked, as it takes up much water from the air. It has no particular advantages.

Caustic Alkalies.— Sodium, potassium, and lithium hydrates are called for by some formulas. They are dangerous substances to handle. When dissolved, they are rapidly converted to carbonates, so their strength is uncertain. They act vigorously on the skin as well as on gelatine, and had really better not be used unless absolutely necessary.

RESTRAINERS

Potassium Bromide.— Good modern plates generally work free from fog when fresh; but when stale may need the addition of bromide. Improper proportions of sulphite, especially with hydrochinon and its combinations, may cause fog unless the tendency is held in check with a few drops of bromide solution. Certain developers require it, notably metol and amidol. Potassium bromide comes in two forms, crystal and granular. They are the same strength, the granular being simply the crystals ground up. This salt keeps fairly well in 10 per cent or saturated (65 per cent) solutions. The former strength is more generally useful. It is made by dissolving 48 grains of bromide in water and making the total volume 1 fluid ounce. It is conveniently kept in a dropping bottle.

With some developers, acetone sulphite is more efficient than bromide as a restrainer. A few drops of a 50 per cent solution to a trayful of developer are ample.

WATER

Pure water is almost unknown in nature, but fortunately distilled water is seldom a necessity in photographic work. Soft water is to be preferred. Boiled and filtered rainwater is excellent. Permanently hard water, that is, a supply containing lime salts, so that it cannot be softened by boiling, gives sediments with silver nitrate, oxalic acid and all oxalates, the carbonates, and sulphites (when oxidation causes them to form sulphates).

Most waters can be purified by boiling for about 15 minutes in a stoneware crock, being then allowed to stand without agitation and closely covered until cool, and finally poured off quietly into jars or other containers and well covered to keep out the air. A filter composed of alternate layers of sand and animal charcoal will remove organic impurities.

Water is cheap. Don't be afraid to use it freely. Most workers employ too strong a developer and could improve their results greatly by diluting it with at least an equal volume of water. The weaker developer will be found to give more printable halftones in the highlights, in other words, better gradation — less of the "soot and whitewash" effect. In fact, varying the amount of water is almost the only modification of a developer which is worth making.

CHOOSING A DEVELOPER

Every worker has his own individual preference for some particular developer or combination which

gives him the results he likes. Every developer, when properly used, will give good results. Choice, then, is largely a matter of personal taste. Some workers will not use anything but pyro; others reject pyro with scorn in favor of one of the more recent agents: but the truth is that it matters little what developer is used so long as the worker learns its peculiarities.

Tank pyro is excellent. Tray pyro may run from about 1 to 2 grains to the ounce, according to the type of negative one desires for a particular printing paper. The main thing is to use it rather weak and with extra sulphite to prevent the increase of the water from causing stain.

Metol-hydro. or M.-Q. is unquestionably the most popular developer for amateurs. Best results are secured by using two separate formulas, one for plates and a stronger one, with much greater proportion of hydrochinon, for prints. Makers' formulas are safe to follow. There are also many "universal" formulas for both plates and prints, the water only being varied.

Duratol-hydro., edinol-hydro., ortol, and many others are chosen by different workers. In the appendix will be found a collection of tried formulas.

In general, it is well to choose a developer of medium speed of working, one having a Watkins development factor of not less than 10 or more than 15. Such a developer gives a harmonious negative in a reasonable time.

MAKING UP A DEVELOPER

Apparatus.— To make up one's own solutions — incomparably the cheapest way — it is necessary to have only a very little apparatus. The chemicals called for by the formula, scales, and weights, an accurate graduate, a filter-funnel and some absorbent cotton, a stirring rod, and bottles with sound corks are sufficient. Many little conveniences may be added, if desired. To save time, it is well to gauge the bottles with the aid of the graduate (don't use those with molded graduations — they are seldom accurate) and to paste a slip of paper on the side to show how high it will be filled by a given volume. Then the solution may be made up in a smaller quantity of warm or hot water, poured in, and the bottle filled to the mark. This saves much tedious measuring. Make sure that the scales balance accurately without any load. The weights furnished with most scales are based on the apothecaries' system, up to ½ ounce, as follows:

1, 2, 4, and 5 grains

½ scruple (℈ss)	= 10 grains
1 scruple (℈j)	= 20 grains
2 scruples (℈ij)	= 40 grains
1 dram (ʒj)	= 60 grains
2 drams (ʒij)	= 120 grains

The half-ounce and ounce weights are avoirdupois, and represent approximately 220 and 440 grains each. The apothecaries' ounce is 480 grains (8

drams); but the avoirdupois ounce is most commonly used in formulas, though in most it would make no difference in the working of the solutions whichever one was used. The grain is the same in all tables.

Weighing.— Having laid out the formula and all the ingredients, weigh out the correct amount of each in the order called for by the formula and check each off on the written or printed formula, verifying the weights and making sure that the scales balance evenly when stirred by a light touch of the finger. Do not attempt to get the weight by bringing the scales to rest on center. After all the ingredients are weighed out, it is well to check them a second time. A helpful procedure is to start with all the bottles, cans, etc., at one hand and transfer them one by one to the other hand as used, to prevent leaving anything out. Place each chemical as weighed on a clean sheet of paper.

Dissolving the Chemicals.—"Water, so many ounces" or "Water to so many ounces" means that the whole volume of the solution should be made up to that amount when finished. It is customary to take a little less at the start and add the requisite quantity after all the chemicals are dissolved, particularly if warm or hot water is used.

Pyro.— Except in the case of solutions for tray or tank which are to be mixed and used at once, pyro is always made up in two or three stock solutions. The A or No. 1 contains the acid preservative, pyro, and

often sulphite. It is essential to dissolve the acid first.

Metol.— All developers containing metol should be made up with warm water and the metol completely dissolved before adding the sulphite. If this is not done, part of the metol combines with the sulphite and forms an insoluble sediment, thus weakening the developer.

Duratol.— This new developer is precipitated in crystals if either sulphite or carbonate alone is added to its solution; but if the sodas are well mixed in the dry state before dissolving, or dissolved in part of the water, crystals do not form.

Amidol.— In using amidol, dissolve the sodium sulphite first, then the amidol, and lastly the bromide. The solution should not be depended upon if more than a day old, except in the case of acid amidol, which keeps well for about two weeks.

In General.— Dissolve each chemical completely before adding the next. Filter rapidly through absorbent cotton into a clean graduate and make up the volume to the amount called for by the formula. Keep bottles filled to the neck and tightly corked. If the solutions are to be stored, dip cork and neck into melted paraffin wax to seal them hermetically. Label each bottle neatly. It is a good plan to write the formula on the label with Higgins' Waterproof Drawing Ink and coat with shellac when dry.

The solutions being ready, we are now in a position to discuss

METHODS OF DEVELOPMENT

There are two main methods of development, tray and tank. The former may be carried out by (a) inspection, (b) factorial, or (c) thermo methods; but the latter depends entirely on the thermo, or "time and temperature" idea. Let us first discuss the old-fashioned way of judging density by ruby light.

Tentative Development.— For this system, a "safe" ruby light is required. It should be tested by exposing a plate for several minutes in a holder with the slide half drawn and laid in the place usually occupied by the developing tray. Develop the test plate several minutes in total darkness and rinse it well. If, on examination in daylight, the exposed end is darker than the other, add ruby glass or orange postoffice paper to the light and test again. Plain plates will stand more light than orthochromatic plates, but no plate should be needlessly exposed to even a "safe" light, as many cases of so-called chemical fog blamed on the developer can be traced to improper ruby light. One sheet of "copper-flashed" ruby glass, with one of orange glass and one or two thicknesses of postoffice paper will be found good with oil, gas, or a weak electric bulb. An excellent deep-red safelight is sold under the name of Isochrom. The light should be about two feet away from the plate during development.

Having everything ready, and all white light completely excluded, lay the plate face (dull side)

upward in a clean tray and flow it with developer. The correct way to do this is to hold the tray in the left hand with the nearer right corner lowest, and hook the edge, not the lip, of the graduate over the rim of the tray. Then pour in one even sweep, sliding the graduate along the right-hand edge of the tray and at the same time tilting the tray so as to carry the wave of developer quickly over the surface. If this is properly done, the plate will be wetted evenly and no air-bubbles can form. Now rock the tray in both directions, set it on the table, and cover it with a larger tray, a piece of cardboard, or anything else which will exclude the light during the early stage of development, when the plate is most sensitive. In half a minute, more or less, look at the plate. It will be found that it is becoming black in places where the light has acted most strongly — the highlights of the image, so called because they are white or high in tone in the original subject. The half- or middle-tones soon follow, and, as development proceeds, the shadow details make their appearance on the yellow portions of the surface.

By the old plan, the operator judged whether his exposure was correct by noting the rapidity with which the different portions of the image appeared and juggled with his solutions, adding water, pyro, alkali, or bromide to "correct" the error in exposure and modify the negative. Many workers still stick to these manipulations, believing that they can usefully modify their results; but careful experiments

have proved that they delude themselves. It is true that underexposures of a certain degree are better treated in a moderately dilute solution, but the writer recommends such for general work. It is also true that overexposures can be usefully modified by employing a strong, heavily restrained developer *from the start*, and terminating the process before the holding-back power of the bromide is gone. It seems, however, much better to make sure of reasonably correct exposures by the use of a table or a meter, when all exposures may be developed alike with good results. The question then becomes, when to stop development?

Judging Density.— The exposure having absolutely determined the amount of shadow-detail, one's only concern in development is to secure a suitable amount of contrast between the highlights and the shadow details. A few failures will probably be experienced before one can learn to estimate well how dark the plate should look before it is fixed. Early in development, the whole image shows clearly on the surface. As the image gains in opacity or density, however, the surface becomes clouded. If, now, the plate is held up before the ruby light with a finger behind it and near the principal highlight, one can compare the blackness of the shadow cast by the finger with that of the silver deposit. As a general rule, development should be stopped as soon as the highest light becomes as black as the finger shadow. Another test is to note the

appearance of the image on the back of the plate. Both of these tests are uncertain, varying with the brand of plate and the developer in use, as well as with the character of the subject. Given a good plate and pyro, for instance, portraits, interiors, and contrasty subjects as a class should be carried only until the *first* highlight comes clearly through on the glass side; landscapes, until all the lights are fully through; and flat, evenly lighted subjects, copies and line drawings, until all the details show plainly on the back.

Negatives made by this method can be altered at will; but it is uncertain at best and does not yield negatives of uniform printing quality. One's eyes play tricks in red light. The first plate may be carried too far; subsequent ones, not far enough. The tendency is to overdevelop and get negatives with too much density in the lights, and constant practice is necessary, with many failures sure to occur before reasonable skill is attained. For these and other reasons, most beginners will find it better to start with the second method.

Factorial Development.— Each developer has a factor, or relation between the time of first appearance of the image and the total time of development. For instance, a 2-grain pyro has a factor of 12. If the image appears in 20 seconds, the total time from the beginning is 12×20 seconds, or 240 seconds, that is, 4 minutes. It is necessary to count seconds accurately to note the appearance of the first highlight

and then perform the multiplication and note the time at which the process will be finished. The method makes allowance for temperature and brand of plate; but it is liable to serious errors in timing and danger of fogging the plate, and is not scientifically correct for over- and under-exposures, which should be developed the same time as correct exposures. Notwithstanding all its drawbacks, it will give better average results in the hands of the beginner than development by inspection, and will in time fit him to judge density accurately.

The factor is generally given with a formula. Each user has the privilege of using a different factor if he prefers. Thus, a given developer may be used with factors of 10, 12, or 15, for soft, medium, or extreme contrast, as desired. It is a great advantage to use a factor which divides evenly into 60 (the number of seconds in a minute), as the calculation then becomes a division instead of a multiplication. Thus, 60 divided by the factor gives a divisor, and the number of seconds for appearance divided by this divisor gives the number of minutes to develop. For instance, 10 is contained in 60, 6 times; 12, 5 times, and 15, 4 times. Hence, using these divisors an appearance of 40 seconds would give respectively 6⅔, 8, and 10 minutes.

TABLE OF FACTORS

(From "The Watkins Manual")

	Grains pyro to ounce	Grains bromide to ounce	Factor
Pyro-soda without bromide	1		18
	2		12 (divisor 5)
	3		10 (divisor 6)
	4		8
	5		6½
Pyro-soda with bromide	1	¼	9
	2	½	5 (divisor 12)
	3	¾	4½
	4	1	4 (divisor 15)

Pyro-acetone, about double the figures given above.

Adurol	5 (divisor 12)
Hydrochinon (minimum bromide)	5 (divisor 12)
Hydrochinon (maximum bromide)	4½
Eikonogen	9
Metol	30 (divisor 2)
Glycin (sodium carbonate)	8
Glycin (potassium carbonate)	12 (divisor 5)
Paramidophenol	16
Amidol (2 grains per ounce)	30 (divisor 2)
Rodinal	18
Ortol	40
Edinol	20 (divisor 3)
Diamidophenol (Dianol)	60 (divisor 1)
Metoquinone (Quinomet)	30 (divisor 2)
Imperial Standard pyro-metol	9
Metol-hydrochinon (average)	14
Azol	40
Duratol-hydrochinon	12 (divisor 5)

To find the factor for a combination developer, add the factors for the parts and divide by the number of parts. Thus, if a developer contains 10 grains (1 part) of metol and 30 grains (3 parts) of hydrochinon, the calculation is:

$$\frac{30+5+5+5}{4} = 11\tfrac{1}{2}, \text{ or approximately } 12.$$

To calculate grains of pyro to an ounce, find the total volume of completed developer which is made when the stock solutions are mixed and diluted for use and divide the grains of dry pyro used by the number of ounces. Example: A three-solution pyro-soda contains 1 ounce avoirdupois (roughly 440 grains) of pyro. Each stock measures 16 ounces, or 48 ounces in all, and 1 ounce of each stock is taken together with 8 ounces of water. The total quantity of developer is therefore 48+128 (16×8), or 176 ounces. Now, 440÷176=2.5, so the developer contains 2½ grains of pyro, to the ounce and its factor is midway between the two- and the three-grain pyro factors in the table, namely, 11. Probably this solution could be used with a factor of 10 for soft negatives and with one of 12 for hard negatives with perfect satisfaction.

The chief objections to the factorial system are the danger of fogging an extremely color-sensitive plate while watching for the appearance of the first highlight and the fact that an error in timing appearance is multiplied by the factor. Both of these are done away with by the next method.

Thermo Development.— Mr. Alfred Watkins, the inventor of the factorial system, has lately perfected the time and temperature method by furnishing complete tables of the relative development-speeds of plates. He classes them from VVQ (very very quick) to VS (very slow). For instance, at 60 degrees Fahrenheit, in a standard M.-Q., the

VVQ plate takes 1¾ minutes and the VS plate 11½ minutes to reach the same stage of contrast. "The Watkins Manual" (60 cents from our publishers) gives complete formulas and directions, including a method by which any user can draw up for himself a table of the times of development for all temperatures for his pet developer and any plate. The code letters indicating development-speeds are given on the speed card issued with Watkins meters. Only a brief explanation can be given here, as space will not permit a full treatment.

Development being entirely by temperature, no inspection of the plate is needed, so no ruby light is required. The developer is mixed to suit the development-speed of the plate and flowed over it in darkness. The tray is then covered and left until the required time is up, when it is removed in darkness (or ruby light if preferred) to the fixer. The thermometer, a watch, and a set of tables take the place of judgment; yet the user can control the contrast to suit his own taste by simply classing the plate higher or lower in the scale. The advantages of this plan are so great that few who try it with care and compare the uniformity of results with the uncertainties of the old methods ever wish to return to the latter. It is the only satisfactory method of handling panchromatic or other highly color-sensitive plates, as the danger of light-struck plates is entirely eliminated. It applies to all makes of plates and films in either tray or tank.

FILM DEVELOPMENT

Tray Methods.— Although the film tank is in almost universal use, a few workers prefer to develop films in the strip by the see-saw method. The film is separated from its paper backing, passed through clear water until limp, and then through the developer. Special trays fitted with removable glass rollers are on the market and are a great convenience in use. The objections to strip development are the danger of fogging the modern color-sensitive films by exposure to unsafe ruby light and the difficulty of stopping development at the right time. The best guide is the apppearance of the image on the back. It should be plainly visible, with most developers. It is, of course, possible to apply factorial or thermo methods to film development in the tray, but these need not detain us; nor need we spend any time over the ancient method of cutting the exposures apart for separate treatment. We now know that the function of development is simply to produce a certain amount of contrast in the negative, and if, through faulty timing, some negatives are thin and some dense, they can be taken care of in printing by choosing hard or soft papers. Extreme cases may require intensification, reduction, or both; but it is preferable to avoid modifying the developer and give more thought to securing the right exposure.

The Film Tank.— Tank development of films is the modern way. It is the application of time and

temperature development to one emulsion, using a fixed strength of developer. The only variable factor is the temperature, and this is compensated for by reference to a table giving the allowance to make for each degree over or under the standard temperature of 65 degrees Fahrenheit.

Space does not permit the full discussion of the principles and operation of the tank, for which the reader is referred to the instruction booklet given with each one sold. There are, however, a few points which may advantageously be taken up.

The first is the importance of following instructions to the letter. Don't blame the manufacturer for bad results unless you are sure you have carried out every step exactly as described. Make sure the film is fastened to the backing paper at both ends before rolling it up in the black apron. Get the temperature as near 65 degrees as possible and take precautions to keep it there if the surrounding air is warmer or cooler, preferably by setting the tank in a pail of water at the right temperature. Use an *accurate* thermometer. Don't neglect to reverse the tank at regular intervals of about three minutes during the whole course of development. The developer is weak and only a thin layer of it is present between the film and the apron, so it must be kept moving if streaks and stains are to be avoided. Finally, don't exceed the time for the temperature, for pyro, even when weak, has a tendency to fill in or "plug up" the gradations in the denser parts of

the negative, and correct development is just as important in the tank as in the tray. In many cases, a slightly shorter time can be given with advantage, if the negatives are intended for printing on gaslight papers.

Tank development is not an infallible means of producing perfect negatives. The only perfect negatives are those which have received precisely the right exposure. Yet, on account of the weakness of the developer, the tank brings out all the detail which has impressed the film sufficiently to be developable, at the same time preventing the usual beginners' fault of overdeveloping. Underexposures accordingly yield all that they are capable of producing. Normal exposures give normal negatives. Overexposures, too, give better negatives than would result from tray development by inspection, for novices invariably snatch them too soon from the developer. So, if your negatives are not good, don't worry about the developing. Find the error in exposure and correct it the next time you take a similar subject, consoling yourself with the thought that no method of development could have given you a much better negative from the bad exposure.

During fifteen years, I have exposed and developed thousands of films and plates for the purpose of proving or disproving theories of all sorts, and I can honestly say that I have never got such good, uniform negatives by any methods of modifying the developer as I secure without trouble by insuring

correct exposure and allowing development to be controlled by the thermo system exclusively. Development is a purely chemical process and subject to natural laws. The only thought which one needs to take is to select a developer which suits the plates or films one uses and gives a suitable negative from a correct exposure. Each developer has its peculiarities, its advantages and disadvantages. All will give splendid results if properly used in suitable strength. Choose whichever you fancy, stick to it, and learn to use it to produce the contrast you wish, leaving to exposure the rendering of detail, and you will find no mystery in development.

APPENDIX

Modifying a Developer.— Although all developers will as a general thing respond readily to variations of water alone and yield softer or harder negatives as this important chemical is increased or decreased, special requirements sometimes make it necessary to vary the other ingredients. The principles are as follows:

Increasing the reducer gives greater contrast and density, with less gradation in the highlights. Decreasing it gives a softer, more delicately graded negative.

Increasing the sulphite, with pyro, gives a blacker negative. Diminished sulphite allows the formation of yellow pyro stain, so that the user can control the printing quality of the negative. The proportion of sulphite should be increased when a normal formula is diluted for tank use. Developers compounded with hydrochinon may cause fog if the sulphite is present in too small amounts, owing to its solvent action on silver bromide. Increasing the sulphite stops this trouble.

Increasing the carbonate makes the developer work more rapidly, softens the gelatine, and may cause frilling or fog. This ingredient may be increased in cold weather and decreased in hot weather, if the temperature of the solutions cannot be kept between 60 and 70 degrees.

Bromide has a restraining action during the early stage of development, but this influence disappears if

development is prolonged. It has a slight effect in holding the shadows clear with stale emulsions; but its chief use is in treating overexposure when the fault is known in advance and much bromide is added to a strong developer before the plate is immersed. The moment signs of fog appear in the shadows, development must be terminated, and intensification subsequently be carried out if the density of the lights is not sufficient.

All of these ends are more simply reached by varying the water and the time of development. To produce less contrast between the tones, add water; to produce more, diminish the water. Or, using a fixed strength of solution, develop a shorter time for soft and a longer time for hard results. All developers give identical results if the plate is carried to the same stage of contrast with each, though some work quickly and others very slowly.

Weights and Measures.— Apothecaries' weights are used for grains and avoirdupois for ounces.

1 scruple (℈j)		= 20 grains
3 scruples (℈iij)	=1 dram (ʒj)	= 60 grains
½ ounce avoirdupois	=218.7 grains, roughly	220 grains
1 ounce avoirdupois	=roughly	440 grains

Fluids are measured by the following table:

60 minims (♏LX)	1 fluid dram	(60 grains water)
8 drams (ʒviij)	1 fluid ounce	(480 grains water)
16 ounces (ʒxvj or Oj)	1 pint	(1 pound water)
32 ounces	1 quart	(2 pounds water)
128 ounces	1 gallon	

The metric weights and measures in common use and their equivalents are:

Volume	Weight	Equivalents	
1 c.c.	1 gram (water)	15 minims	15 grains
30 c.c.	30 grams (water)	1 fluid ounce (roughly)	450 grains
1,000 c.c. (1 liter)	1,000 grams (water)	33½ fluid ounces	

FORMULAS

Pyro.— For twenty-minute tank development of films at 65°. Multiply each weight by the number of ounces needed for the tank in use.

Water	1 ounce
Sodium sulphite, anhydrous	1.875 grains
Sodium carbonate, anhydrous	1.25 grains
Pyro	0.625 grain

The stainless pyro formula of "The British Journal of Photography" is:

A.—	Neutral sulphite solution	14 ounces
	Pyro	160 grains
	Water to make	20 ounces
B.—	Sodium carbonate, dry granular	2 ounces
	Water to make	20 ounces

Take A, 1 part; B, 1 part; water, 2 parts. This gives a 2-grain pyro, factor 12.

The neutral sulphite solution is:

Sodium sulphite, anhydrous	2 ounces
Potassium metabisulphite	½ ounce
Water to make	20 ounces

The neutral sulphite works better if boiled.

Pyro-Metol.— A typical three-solution formula is:

No. 1.—A.—Hot water	18	ounces
Oxalic acid	20	grains
Metol	70	grains
Sodium sulphite, anhydrous	2	ounces
B.—Pyro	1	ounce
Cold water	6	ounces

Add B to A when A has cooled.

No. 2.— Sodium sulphite, anhydrous	3	ounces
Water to	24	ounces
No. 3.— Sodium carbonate, dry granular	2	ounces
Water to	24	ounces

Take, for tray, 1 ounce each of Nos. 1, 2, and 3 and 10 to 15 ounces water; for tank, 2 ounces each of Nos. 1 and 2, 1½ ounces No. 3, and 60 ounces of water.

Metol. — Hauff's one-solution formula will be found excellent for soft, harmonious negatives.

Water to	20 ounces
Metol	150 grains
Sodium sulphite, anhydrous	550 grains
Sodium carbonate, dry granular	770 grains
Potassium bromide	16 grains

For use, dilute 1 part of stock solution with 1 or 2 parts of water.

Metol-Hydrochinon or M.-Q.— A good all-around formula is E. J. Wall's.

Water to	16 ounces
Metol	25 grains
Sodium sulphite, anhydrous	350 grains
Sodium carbonate, dry granular	260 grains
Hydrochinon	36 grains

For negatives, dilute with an equal volume of water. For papers, use 1 part stock, 3 parts water, and add ⅓ grain of potassium bromide to each fluid ounce of diluted developer.

Amidol.— Balagny's acid amidol, which keeps well for two or three weeks, is:

Water to	20 ounces
Sodium sulphite, anhydrous	420 grains
Acid bisulphite lye (Lumière)	50 minims
Amidol	140 grains

This formula gives a rich, blue-black deposit of great density. An alternative formula, with metabisulphite in place of the bisulphite lye, is given by "The British Journal of Photography."

Water to	10 ounces
Sodium sulphite, anhydrous	120 grains
Potassium metabisulphite	30 grains
Potassium bromide	2½ grains
Amidol	20 grains

Glycin.— A concentrated "paste" of extraordinary keeping qualities may be prepared as follows, using sodium carbonate to prevent the natural tendency of glycin to yield harsh negatives:— Dissolve in 4 ounces of hot water 550 grains of sodium sulphite anhydrous and 1 ounce of glycin. Bring to a boil, and add, a little at a time, 2½ ounces of dry granular sodium carbonate. The paste should be well shaken before measuring out. For use, take 3 parts of paste and 100 parts of water.

Tank development with glycin is peculiar in that an excess of sulphite causes yellow stain. Any

required number of ounces can be made by the following formula:

Water	1 ounce
Sodium sulphite, anhydrous	1 grain
Sodium carbonate, dry granular	1 grain
Glycin	1 grain

This gives proper development of normal exposures in about 25 to 30 minutes at 65 degrees. The negatives are extraordinarily clear and free from fog. Wash plates well before fixing.

Glycin-Metol.— The writer has found a combination developer better than plain glycin for tray work, on account of its quicker action.

Water to	40 ounces
Metol	60 grains
Sodium sulphite, anhydrous	220 grains
Sodium carbonate, dry granular	1 ounce
Glycin	120 grains

Use full strength, or with an equal volume of water. Factor 12 to 15. Wash thoroughly before fixing to prevent yellow stain.

Duratol-Hydrochinon.— Duratol being relatively less soluble than most other agents, the following two-solution developer will be found best.

A.— Water to	32 ounces
Potassium metabisulphite	60 grains

Dissolve and add:

Duratol	30 grains
Hydrochinon	90 grains
B.— Water to	32 ounces
Sodium sulphite, anhydrous	1½ ounces
Sodium carbonate, dry granular	2 ounces

Factor 10, 12, or 15, according to contrast required. Equal parts give too much contrast for most subjects. A good strength for plates is 1A, 1B, 2 water. This developer works better than most over a wide range of temperatures.

INTENSIFICATION AND REDUCTION

Several times in the course of this discussion, the writer has hinted his preference for straightforward development, with after-treatment in reserve to improve the printing quality of negatives which accidentally received incorrect exposures. There are a few simple formulas which work well.

Mercuric Iodide Intensifier.— The greatest advantage of this agent is that it can be used without freeing the plate from hypo. A short rinse after fixing is all that is needed.

Water	6 ounces
Mercuric chloride (corrosive sublimate)	120 grains

Add the following until the red precipitate first formed is redissolved.

Water	6 ounces
Potassium iodide	1 ounce

For use, dilute with an equal part of water and pour on the plate, rocking until sufficiently intensified, then blacken in any used developer except pyro and wash as usual.

Reducers.— Two sorts of reducers are needed, one which attacks the shadow detail without affecting the dense deposits; the other, one to reduce the lights without destroying any shadow detail. The typical reducer of the first class is Howard Farmer's ferricyanide-hypo.

Farmer's Reducer.— Make a saturated solution of potassium ferricyanide (red prussiate of potash) in a yellow glass bottle and keep it in the dark. It keeps better if double its weight of table salt is added. For use, dissolve 1 ounce of hypo in 8 ounces of water and add enough ferricyanide to make it a straw color. If the dry negative is treated with a solution weak in ferricyanide, greater proportionate reduction of the highlights takes place. If the ferricyanide is in excess and the plate has been soaked in water, the reducer removes all of the shadow detail before it begins to act on the lights. Photographers who use plain hypo often reduce their negatives as they take them from the fixer by swabbing them with a tuft of cotton soaked in the ferricyanide solution. The action is very rapid, and care must be taken to rinse quickly before removing the plate from the tray for examination. The reducer does not keep more than a minute or two after mixing.

Acid Permanganate.— The other type of reducer is best represented by potassium permanganate used with an acid, though ammonium persulphate is generally recommended. The latter, however, is

unreliable, whereas the former is quite dependable. Perhaps the simplest formula is:

Water to	20 ounces
Alum, crystal	1 to 1¼ ounces
Potassium permanganate	10 grains

Immerse the negative and rock until sufficient reduction of the highlights has taken place; then place without rinsing in a weak solution of either sodium bisulphite or potassium metabisulphite to remove the brown stain, and finally wash well. The exact strength is not material, so long as it is weak, and if preferred a stock solution of permanganate can be kept and acidified at the time of use with a drop of sulphuric acid.

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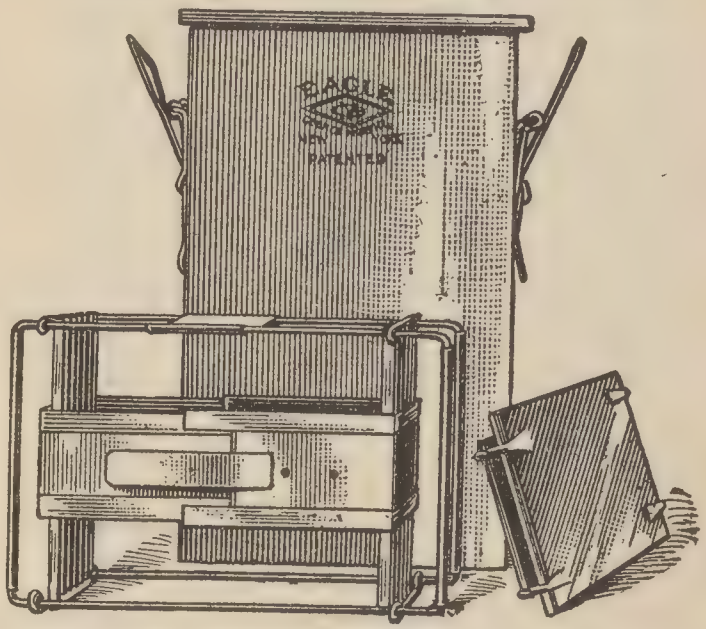

Superior to all other makes for the reason that it is adjustable to any sized plate smaller than the size for which it is listed; thus one tank will serve for various sizes of plates. The cover is held with clamps, so that the tank can be reversed as often as desired. The rack is so constructed that it slides up and down on four rods. These rods project above the solution serving as a handle for removing rack without touching the solution with your hand. This is not possible with any other tank on the market. Made of brass, heavily nickel plated.

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Some Original Ideas on Portraiture, Indoors and Out, by Daylight, Flashlight and Artificial Light

By FRANCOIS VOITIER

AND

Dr. MALCOLM DEAN MILLER

Fourth Edition

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No. 3 of the American Photography Handbooks

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WHEN the amateur first essays to portray his friends, the results are usually far from pleasing. This is due to a variety of causes, the recognition and avoidance of which it is the purpose of this booklet to explain. It is only by approaching the problem of home portraiture with an intelligent idea of the difficulties and the ways to surmount them that acceptable likenesses can be made.

Mental Equipment.—Most camera owners quickly acquire a good knowledge of outdoor work in its different branches and have little difficulty in securing creditable prints of subjects which interest them, when once the exposure problem has been mastered.* When, however, they apply their experience to the field of portraiture, they soon find that methods of handling the negative must be very different if the results are not to be unspeakably harsh and distressing to those who know the sitter. It is necessary, therefore, to review carefully their knowledge of development in order to be able to produce softer, thinner, and altogether more harmonious negatives than they habitually make of landscape subjects. Some thought must also be given to the use of soft-working papers, and in addition, an entirely new mass of facts about posing, lighting, exposing, etc., must be more or less labo-

*See No. 2 of these Handbooks, "The Secret of Exposure."

riously acquired. It is to shorten and render less difficult the operation of storing up these facts that this booklet is written; but we must presume that the reader has already acquired a good general knowledge of photographic processes.

What is a Portrait?—Before beginning the serious consideration of any subject, it is important to know just what we mean by the words used in connection with it. A portrait, in the common meaning of the term, is a picture of a person which has "likeness," and at the same time expresses the way in which the maker saw the sitter. For our purposes, the attribute of likeness is more important than anything else, for what we desire is to show the aspiring amateur how to make good likenesses of his sitters. The subject is a complicated one, but we shall endeavor to simplify it by giving specific birections which shall almost automatically ensure that the picture shall resemble the sitter.

Portraits in the Home.—Likeness is so much more easily secured among home surroundings that even professional photographers are making a specialty of going to the houses of their patrons and taking them in natural poses and with the ordinary furniture of the room as accessories. Their knowledge of lighting, exposure, development, and printing is what makes it easy for them to secure good results; but the amateur can by a little study master these points and is then in a position of advantage—knowing his sitters intimately, he should be able to do even better work than the professional.

The Common Causes of Failure.— Since any camera which can be arranged for time exposure will take a portrait, the chief limitation imposed by the ordinary types of amateur apparatus is that of size of the image. Enlargement is the easiest way to make a small image bigger—often far better than to use the lens close to the subject,

whether with or without the supplementary lens called a "portrait attachment." No matter what camera you have, then, you can make a portrait with it if you take care not to have it so close to the sitter that the image cannot be focused. The second chief cause of failure is harsh lighting. Next comes underexposure, generally accompanied by overdevelopment in too strong a solution; and, finally, unsuitable finishing of the picture. Let us discuss these topics more in detail.

Perspective and the Lens.—Professional photographers employ lenses of longer focus than those ordinarily used by amateurs. For example, it is not unusual for a cabinet ($3\frac{7}{8} \times 5\frac{1}{2}$) portrait to be made with a 13-inch lens; but the amateur with a postcard camera ($3\frac{1}{4} \times 5\frac{1}{2}$) is generally restricted to one having a focal length of $6\frac{1}{2}$ inches. Now, from the same point of view, or distance from lens to sitter, the 13-inch lens will make an image exactly twice as large as the $6\frac{1}{2}$-inch lens. If this distance is $8\frac{1}{2}$ feet when photographing only head and shoulders, the length of the head from top to chin will be in the first case 1 inch and in the second $\frac{1}{2}$ inch. By enlarging the smaller image two diameters (to 1 inch long), the smaller lens will give the same results as the bigger and more expensive one. The important thing to remember is that 10 times the focal length is the very closest that the lens should *ever* be brought to the face of the sitter for a portrait, because it is the nearest distance which will give natural perspective. The subject of perspective in general is too big to go into here; but this one fact, as just stated, should be at once committed to memory and then if you depart from the rule you will know that the lack of likeness is due to distortion from bad perspective drawing of the features. From an artistic point of view, this rule bars the "portrait attachment," which has

generally to be used with the lens 3½ feet from the face of the sitter. If you doubt the distortion, take two pictures of the same subject, one from 8 feet (most kodaks have this mark on the focusing scale) with the regular lens, the other from 3½ feet with the portrait attachment, and compare the prints from the negatives. In the same manner, 17 feet is the ideal shortest distance between lens and sitter for a full-length figure. Of course, one cannot get as far away as that in most houses, but the nearer one can come to it the better the perspective is sure to be. The lesson of this paragraph, then, is to disregard the size of the image on the ground glass and rely on enlarging if a head larger than the lens will give at 10 focal lengths is desired.

Harsh Lighting.—Ask a friend to sit near a large window and as close to it as he can get and observe from a position near the wall the light on the face. Then have him move into the room a foot at a time, watching how the light spreads and diffuses over the face as he increases the distance from the source of light. This simple experiment will teach you at once the reason why most amateur's pictures of their friends are of the "soot and whitewash" order. The sitter has been placed too close to the light. All the illumination has been concentrated on the lighted cheek, and the contrast between it and the shaded one is so great that no ordinary exposure could record any detail. In addition to harshness, there is usually the wrong direction of the light, which, for portraiture, should come mostly from above the head, instead of from the same level. Furthermore, it will be seen that a reflector is often essential to lighten the shadow side of the face and by thus bringing it nearer in tone to the lighted side to allow a reasonably short exposure.

Exposure.—It may be laid down as a rule that it is seldom possible in home portraiture to over-

expose, though if a flat lighting is chosen, the contrasts of light and shade are almost destroyed and a flat result will follow too generous an exposure. However, exposures indoors are usually several hundred times those which would be necessary outside on the same day. Light subjects, such as children in a white-painted room full of windows, may perhaps be secured with a slow snapshot and an *f*:4.5 lens; but rooms in which the exposure mounts into seconds are far more common. Experience, guided by an actinometer exposure-meter, such as the Watkins or the Wynne, must be relied on to teach you the time to give in the circumstances which surround your own work. The method of using the meter, however, is so important that we had better explain it in detail.

Assuming that a Watkins Bee meter is being used, first pose and arrange your subject and as soon as the exact position he is to occupy is found, test the light. Holding the meter close to the head of the subject and facing the window, expose a section of the sensitive paper and note the time by the watch. As soon as a faint gray tint is visible, note the number of seconds which has expired. This first visible darkening of the meter paper is the sixteenth tint. Multiply the number of seconds by sixteen, to obtain the full actinometer time for calculating the exposure. This method saves time and gives a more certain means than any other of determining the exposure in strange surroundings. Exposure-tables can, however, be used with success, particularly if one makes a series of trial exposures in order to select the right factors for local conditions. For instance, the *Photo-Beacon* Exposure-Card gives the factor for "indoor portraits" as 8 to 10. The smaller of these might be sufficient in a light-colored room near a large window with the sitter dressed in light

colors and plenty of reflected light on the shadow side, either from objects in the room or a white reflector; the larger might not be great enough in a small, dark room with red paper, and a value of 12 or 14 might have to be adopted.

Improper Lighting and Exposure.—If the shadow side is too dark—so shrouded in gloom that the local color of the skin cannot be seen throughout—it will be found almost impossible to give enough time to get anything but coal-black shadows and chalky highlights. When the lighting is correct, the color of the skin can be seen everywhere and the shadows will not look much darker than the lighted side: in these circumstances the exposure will be short and the result soft and yet brilliant.

The Camera.—Successful portraits can be made with any instrument capable of being set for time exposures. Even the cheapest box-form cameras with *f*:16 meniscus achromatic lenses and a portrait attachment will make good pictures if the lighting and exposure are well managed. A folding kodak or camera is used with satisfaction by thousands of amateurs. The more elaborate instruments, with rise and fall of the front and vertical swing back (or its equivalent, the swing bed) of course give a greater range; but the ordinary camera is sufficient. An *f*:8 rectilinear is excellent, and, if the bellows is long enough, one can make very good portraits by using the rear combination alone. It works at *f*:16 and gives an image twice as large at the same distance or one of the same size at double the distance, thus avoiding false foreshortening from having the lens too close to the sitter.

Camera Support.—A tripod is as good as anything if it can be extended or folded so as to bring the lens about on a level with the mouth of the sitter. It is much more convenient if provided with a truck.

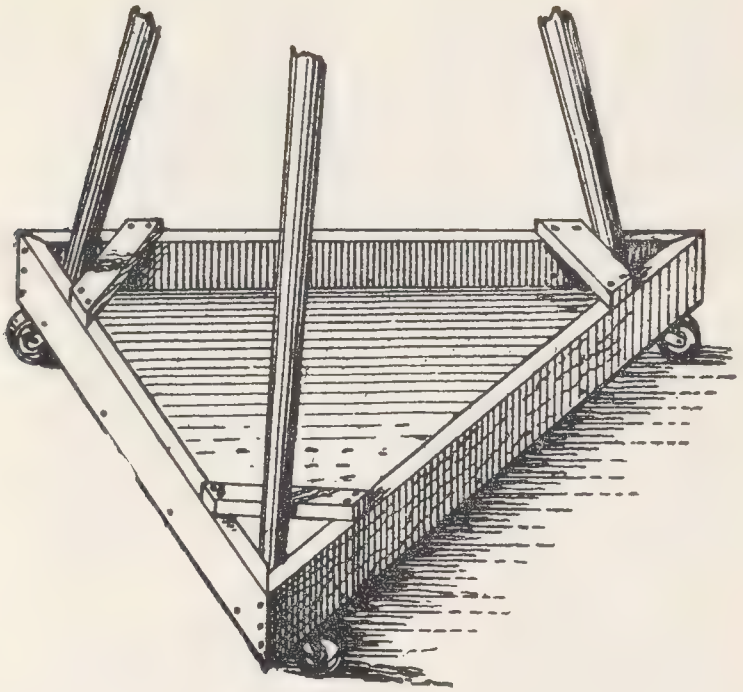


Fig. 1

See Fig. 1. This useful contrivance, which permits one to slide the camera backwards or forwards or sideways, without getting it out of adjustment, I recommend to all who practice home portraiture. Being flat, it can be set almost anywhere out of sight when not in use. This form can be easily made and will prove a great convenience in moving the tripod without slipping. Mellen's folding tripod stay is very good. Special home portraiture stands are also made, and can be purchased from any of the large photo-supply houses or reliable second-hand dealers. Tripod trucks can also be purchased ready made at a small figure.

Vignetters.—This is an article in such common use that it would seem almost superfluous to explain its purpose. But in order to make this booklet complete in itself, let it be said that a

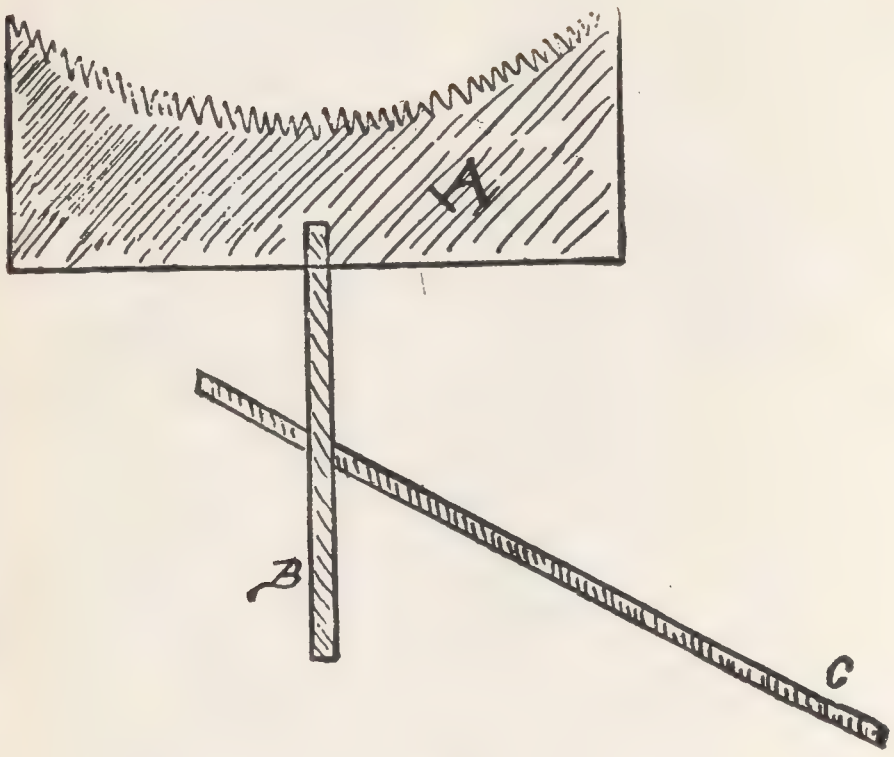


Fig. 2

vignetter is simply a piece of cardboard shaped like a half circle, notched on the concave edge and designed to cut out such parts of the picture as it may be desirable to eliminate. It differs from an ordinary mask in that the latter circumscribes the image by geometrically figured lines, while the former vignettes or blends the undesirable portion into the part eliminated, no well defined line or edge being apparent. This is a very useful little accessory for bust pictures and should form a part of the equipment of every amateur who practices home portraiture. Of course, a vignetter can be purchased from any dealer in professional goods; but it is so simple in construction and made of material found in any home that there is no reason

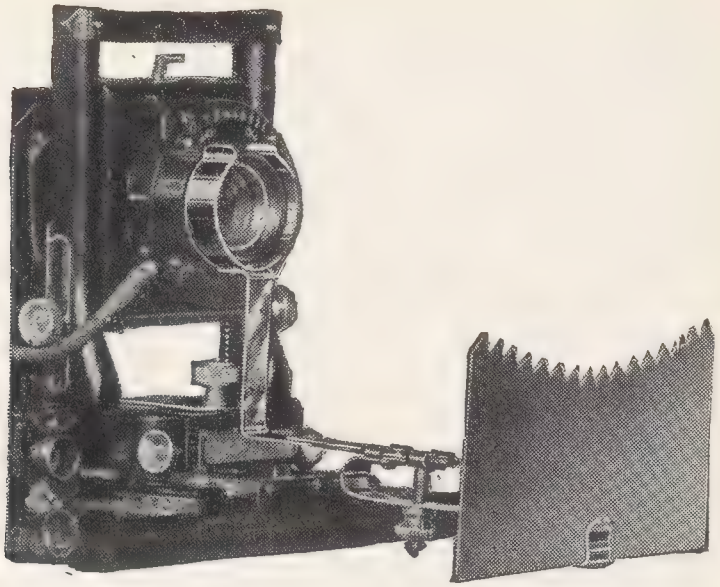


Fig. 3

why the worker should not make one himself and save the expense. The material needed consists of a piece of cardboard and two pieces of wood. Maybe a rough sketch will explain the vignetter and its distance from the lens. See Fig. 2.

Another form of vignetter which is particularly adapted to amateur use is the Morrison, a cut of which (Fig. 3) is presented by courtesy of Burke & James, Inc. As the picture shows, this is simply clamped on the front lens cell. By its use one can easily vignette off the base of the bust, this method being particularly adapted to stout female sitters.

Backgrounds.—Even in work at home, it is often essential to use an artificial background in order to make bust pictures without including distracting objects. Folding backgrounds can be bought for about $1.50 from any large dealer in photographic supplies. They do not wrinkle or crack readily, and are convenient to carry when rolled. Or, if preferred, you can easily make your own grounds.

First purchase sufficient muslin to make the number of backgrounds desired (I suggest six), and after cutting it up into pieces of the required length and sewing the widths together where necessary, nail one section to the wall. It is very essential that it be drawn perfectly taut to remove all creases. Besides the muslin you will need some sizing, brushes, and the colors. For the sizing, take two ounces of glue and let it stand for about two and a half hours in just sufficient cold water to cover it. At the end of this time, after draining off the surplus water, add two quarts of boiling water and stir until completely dissolved; dissolve an ounce of crystallized alum in two pints of hot water and stir it in with the glue. Thin the mixture with six quarts of cold water and the sizing is made. Do not use before cold. As for the brushes, they can be those used by painters, but it is wise to select a couple of a quality and so bound as not to shed the bristles. For the colors, the following material will be needed: three pounds of bolted whiting, about an ounce of brown soap (the commonest kind is plenty good enough), some dry lampblack and a little alcohol. Into enough of the hot sizing to make a thick paste stir the whiting until all signs of lumpiness disappear, when the brown soap, previously dissolved in a quart of hot water, should be added. This forms the basis of the working color. The lampblack and alcohol, made into a paste, furnish the various shades. Now add the lampblack to the whiting mixture little by little until a good gray shade is obtained. Of course, the proportion of lampblack and whiting can be varied according to the particular shade preferred. At this stage we have three separate mixtures on hand besides the sizing—to wit, white, black and gray. Into both the "white" and the "gray" pour hot water to bring them to the consist-

ency of whitewash. They will turn into a jelly as they cool. When cold, thin by adding to each a quart of cold water. Now for the actual painting of the backgrounds.

Size the muslin, putting on a liberal coat. When dry, which will take between two and three hours, paint it all over with the gray color, working quickly. The black and the white can then be laid on according to any design which you may fancy. A good way to start is to put a daub of the white in the center and with a blender (which can consist of a wad of cotton or rags rolled into a ball and covered with a piece of clean linen saturated with water) work the tones or shades into each other so that no lines of demarcation are visible. Every once in a while note the progress of the work by viewing it some feet away and touch it up, where and if needed, with either the black, white, or gray, as the case may be. By the bye, reserve one brush for each color, taking care to keep the black brush out of the white and vice versa. When the background is dry it is ready for use and should be wound around a wooden roller and stood in a corner of your darkroom or some other convenient place. In fact, half a dozen such grounds will occupy but a very small space.

Background Carrier.—Whether you use a bought background or a home-made one, a carrier will prove a great convenience. A cheap and serviceable background may be made out of a piece of unbleached muslin tacked on a frame about 6 x 6 feet, the muslin extending along the floor about six or eight feet more. This extension is rolled up on an ordinary curtain pole when not in use and held on the frame by hooks, and the frame slides in behind a bed or a book-case when not in use.

The frame is supported by bracket feet on casters, held to the frame by bolts which permit them to

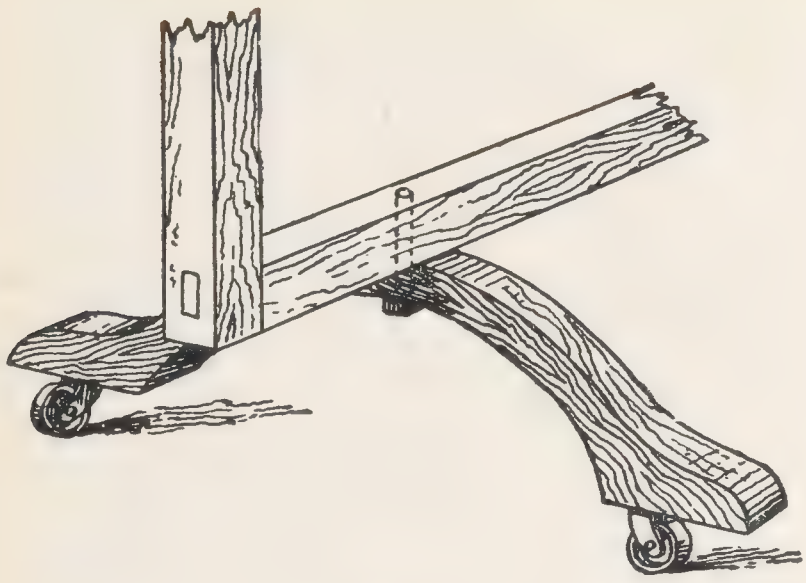


Fig. 4

turn parallel with the frame itself when stowing behind the bed. The sketch, Fig. 4, will explain the construction. Figs. 6, 7, and 8 represent other methods of making the frame.

The object of the extra length of muslin is to make a continuous background, thus avoiding in full length portraits the line of the lower edge of the background across the back of the subject.

If expense is no object, the easiest way to provide good backgrounds for use permanently in a room set apart for portraiture is to purchase the ready-made background brackets with casters, as shown in the cut. This particular style is made by Burke & James, Inc. See Fig. 5.

Side Reflector.—If you have either a room which you can use exclusively for portraiture, or plenty of space to store your apparatus, I would recommend that the reflector (a sheet or a piece of white material) be tacked on a frame specially made for the purpose. Fastened on all four sides, it is kept taut

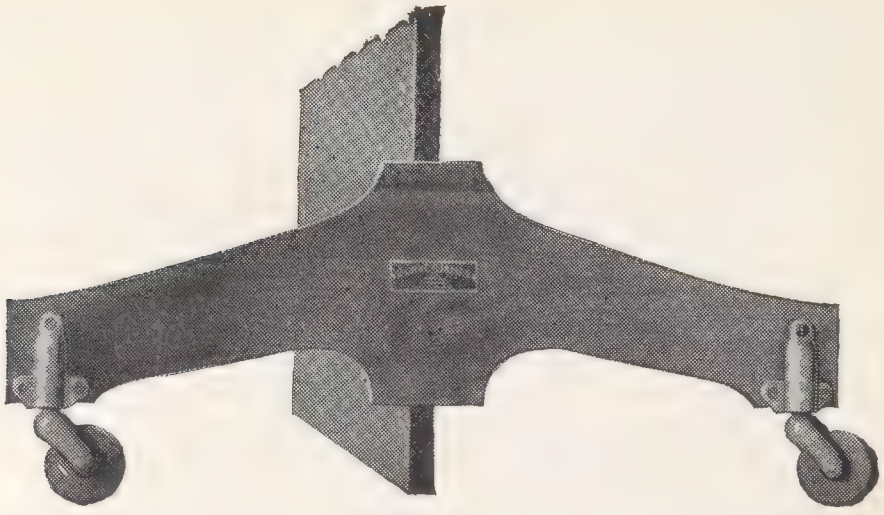


Fig. 5

and free from creases. It is well to brace the frame at the corners to make it more rigid. Within limits, the size is a matter of personal choice, but I would suggest 5 x 5 or 6 feet as suitable and quite convenient to handle too. If, perchance, circumstances were such as to make it desirable to take a picture other than in the room usually used—as, for instance, on the porch, in the garden or beside the house—a too cumbersome reflector would likely prove a nuisance, and if the door happened to be low, it might not be possible to pass it through at all. The reflector might be mounted on two blocks of wood so as to stand alone when required, but this is by no means necessary—merely a luxury, so to speak.

A side reflector is designed to be placed opposite the window for the purpose of lighting up the side of the sitter's face farthest from the light, thus avoiding the harsh effects which otherwise are inevitable. In short, this accessory serves to help distribute the light so that one side of the face will not be black while the side nearer the window is

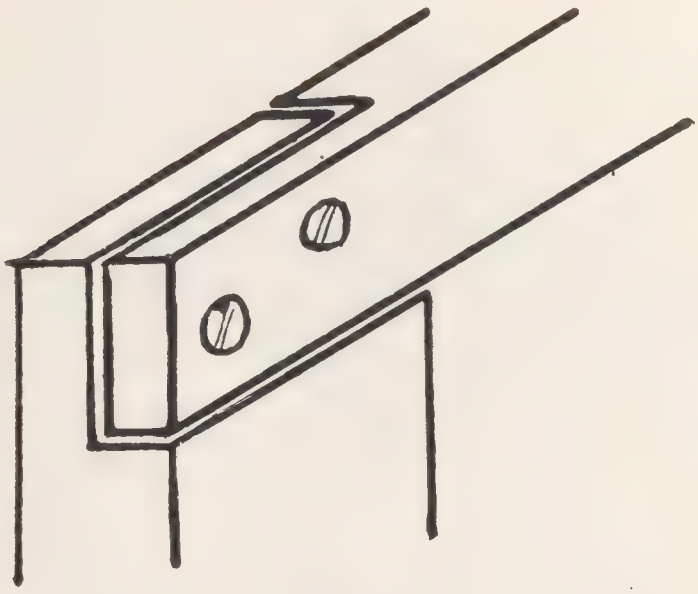


Fig. 6

white and chalky. The best position and angle for the reflector will be referred to in a later paragraph.

Types of Daylight Lightings.—For practical purposes, the forms of lighting which can be secured at an ordinary window are two, broad or three-quarter and Rembrandt. The diagrams illustrate the arrangement of the apparatus. Fig. 9 illustrates a broad lighting. *B* is the background, *R* the reflector; and the camera is indicated by the triangle, which represents the tripod truck, with the front leg of the tripod pointing towards the sitter. The position of the sitter is indicated by the four-sided figure intended to represent a chair seat, the direction in which the broader (front) side faces showing the pose of the body. It must of course be understood that considerable latitude in placing the chair is permissible, for as a rule the body should not be square to the camera. One shoulder

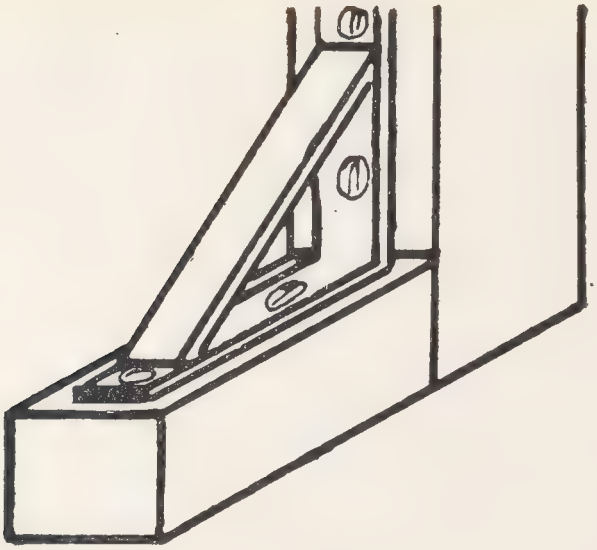
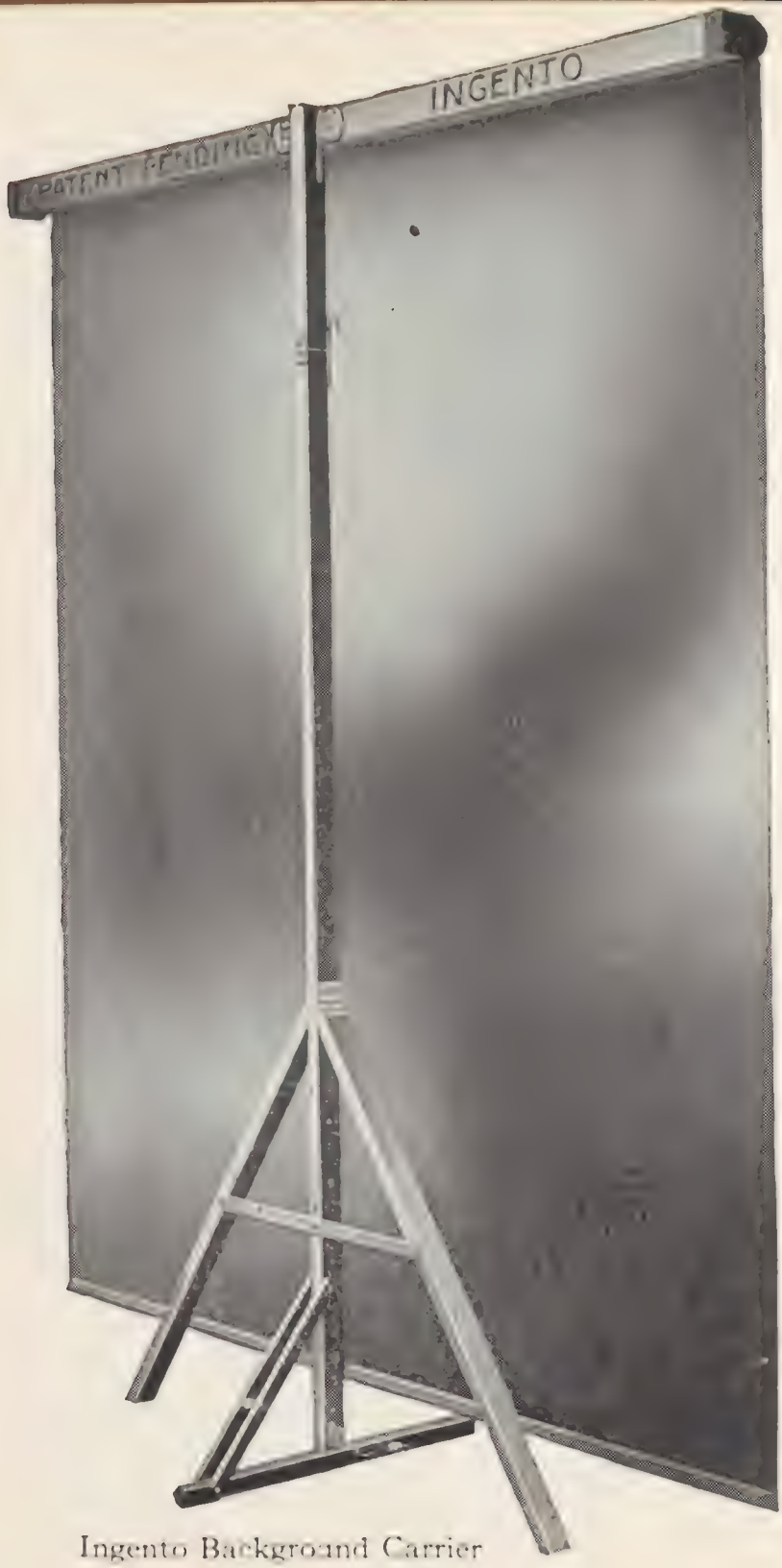


Fig. 7

is generally nearer the lens than the other, and the head is turned towards or from the light until the best view of the features and the proper lighting are obtained.

Taking this particular lighting more in detail, the window (represented by the open space in the figure) is covered with an *opaque* cloth to the same height as the top of the sitter's head. The reason for this is that the light must come from an angle of 45 degrees in order to illuminate the features to good advantage. The absence of a top light, or more properly speaking, the inclusion of light from the bottom part of the window as well, is responsible for most of the faulty lightings turned out in ordinary home surroundings. Place the chair in line with the farther casing of the window and as far into the room as the window is wide. Let the sitter settle himself comfortably in the chair and have him turn his head until the light from the window crosses the bridge of the nose and falls upon the farther cheekbone. Now observe the eyes: a



Ingento Background Carrier

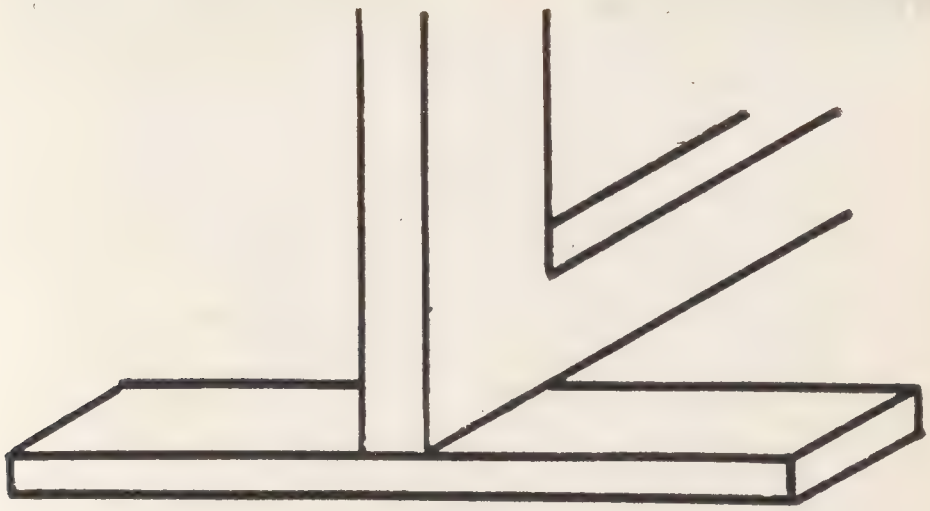


Fig. 8

small, round catch-light will be seen just under the upper lid in each, if the lighting is right; if not, have the head turned slightly until the catch-light is seen clearly in both eyes. Next look at the shadow cast by the nose on the upper lip: it should come not more than half way down the lip and be connected by an area of halftone with the shadow along the lower jaw. Finally, observe the *color* of the skin in both highlights and shadows. Unless you can see the local tint of the sitter's complexion in both, the lighting is too harsh. It may be necessary to stretch cheesecloth over the window to diffuse the light, thus softening the highlights, or to use more reflected light. Note the position of the reflector in front of the sitter and at such an angle that it does not cast false light into the shadows on the back of the head. If it is brought too near, a sort of chalky quality of the shadows will be created by the strength of the reflected light; so be sure that it is far enough away merely to lighten the shadows just enough to bring out the *color* of the skin. Now adjust the camera

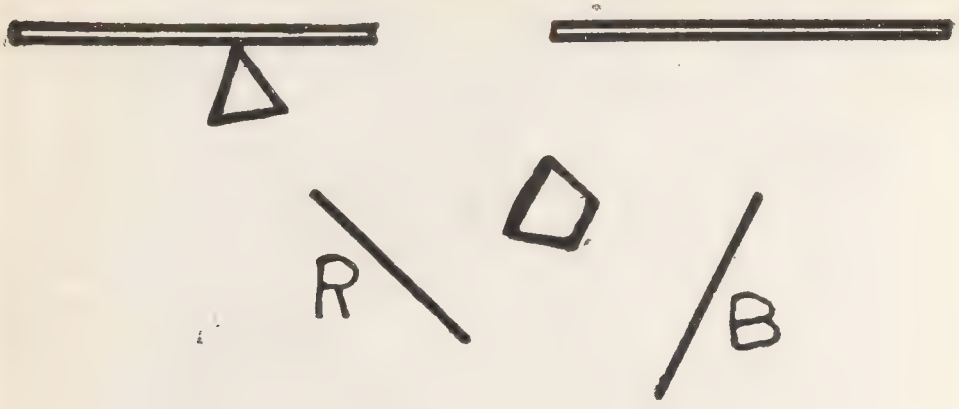


Fig. 9

until the lens is about of a level with the mouth of the subject, with the lens lowered in its front, and focus to get the catch-lights perfectly sharp. It is just here that a camera provided with a vertical swing back comes in most handily, for by using the swing one can focus both the nearer and the farther parts of the body at the same time; the back, of course, not being vertical. The best spacing to work for is with the head of the sitter near the top of the picture space. Given such a lighting, the exposure will be in the neighborhood of from 2 to 6 seconds with a rapid rectilinear lens working at *f*:8 on a plate of speed 0 in the *Photo-Beacon* Exposure-Card (Watkins 350 or Wynne F 111). By using plates of ultra rapidity, such as Central Special XX, Lumière Sigma, Hammer Red Label, Seed 30, or Wellington Extreme, the time may be reduced to about half these figures.

Users of fixed-focus box or folding cameras will have to depend on trimming the print for the final spacing of the subject; but this is easily managed, particularly if the prints are made by enlargement. See American Photography Handbook No. 4, "How to Make Enlargements on Bromide and Gaslight Papers."

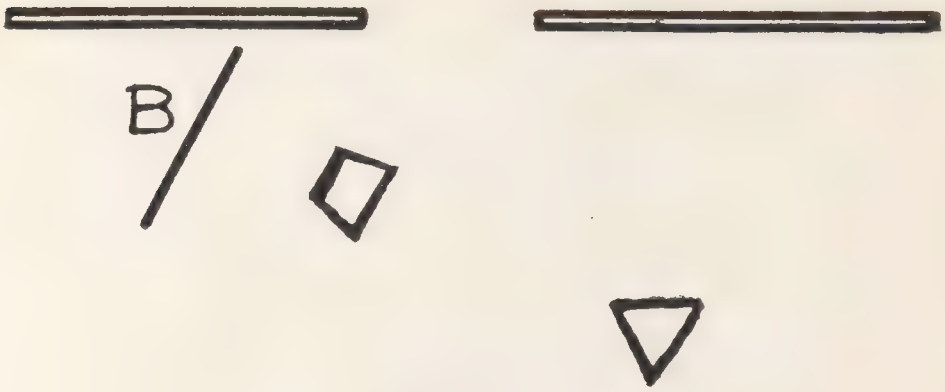


Fig. 10

Rembrandt Lighting.—In Fig. 10 we have the arrangement at the same window for the so-called Rembrandt or shadow lighting. Here the sitter is nearer the window than is the camera. The placing of the chair must be experimented with until the most pleasing view is found. As before, the light should be allowed to cross the nose to the shadowed cheek; but the reflector can be dispensed with if the room is small and there is on this account enough diffused reflected light to allow one to see the color of the skin in the deepest shadow. If not, use a reflector about 6 feet from the subject. The next figure, 11, shows the arrangement for a profile Rembrandt lighting. The sitter is here almost directly between the window and the camera, and a reflector, placed about as shown, is useful to prevent too harsh contrasts. The exposure for both of these positions must be fully double that needed for the arrangement in Fig. 9.

Fig. 12 illustrates another form of broad lighting, with the sitter farther back from the window. In such a position the contrasts are less intense on the face, on account of the light's being more diffused. Shorter exposures are therefore possible.

Window-Seat Lightings.—Very often the window-

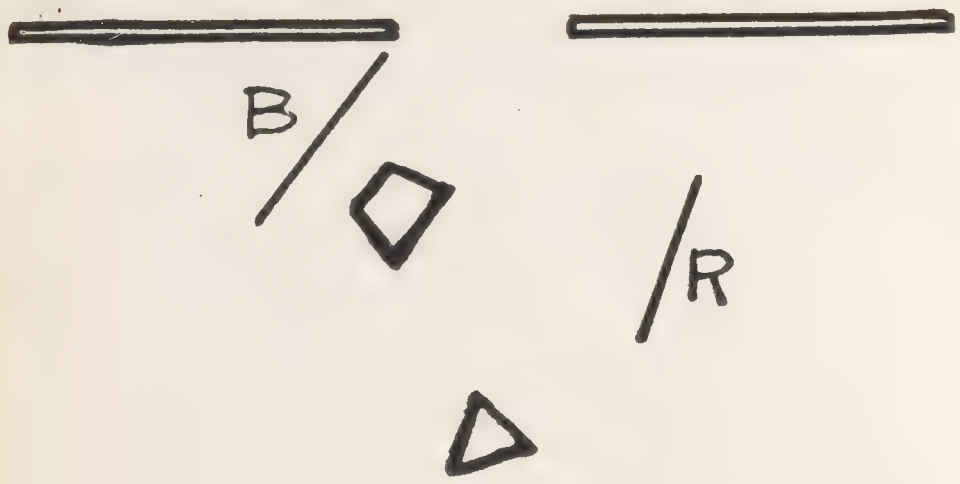


Fig. 11

seat offers one of the very best situations for a home portrait, for the surroundings are simple and the sitter can be posed as if occupied with some entirely natural pursuit, such as reading, tending plants, or what not. Fig. 13 is intended merely as a suggestion to keep the camera as near the wall as possible, so as to work nearly with instead of against the light; and the reflector is shown at some distance from and in front of the subject.

Paul L. Anderson, the eminent pictorialist of East Orange, N.J., gives the following methods for handling window portraits even when direct sunlight is entering the window. We abstract from the July, 1911, issue of *American Photography*: A single achromatic lens is preferred because of its lesser liability to flare—for instance, the rear combination of an ordinary rapid rectilinear or one of the single "semi-achromatic" lenses, commonly called "soft-focus" lenses. A ray-filter should be used in order to reduce the proportionate intensity of the lights, and this presupposes a color-sensitive plate, which should be double-coated or backed to reduce halation. A soft-working developer without

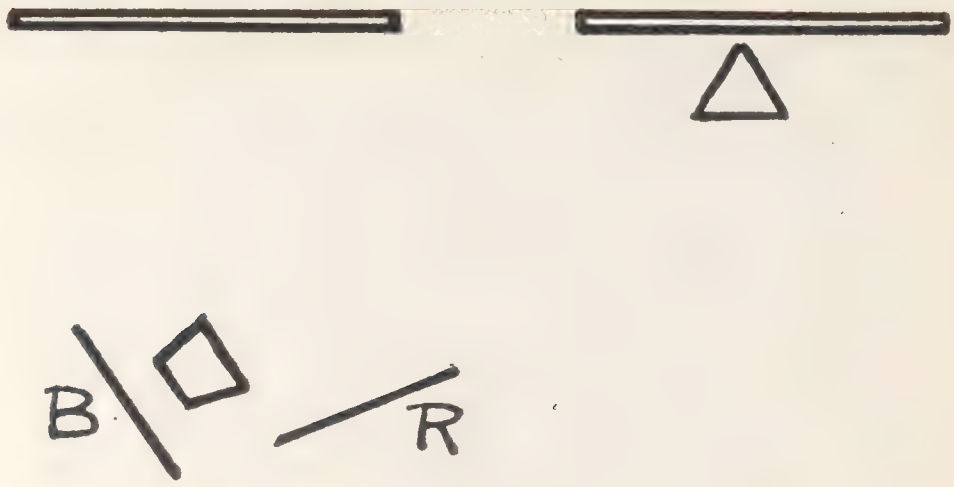


Fig. 12

bromide should be employed, with at least double and preferably four times the usual amount of water. Care should be taken not to overdevelop, it being preferable to underdevelop and subsequently intensify, if necessary, rather than to carry the original development too far. Should the slightest sign of fog appear, the plate should be placed in the hypo as soon as possible, and, if necessary, intensified after it is dry. The class of negative to aim for is one that shall have full detail in the shadows, thin highlights, and almost clear glass in the lowest tones. Of course, such a negative should be printed in diffused light, either in shadow or with ground glass or tissue paper over the printing frame. Fig. 14 shows the arrangement. Mr. Anderson remarks that the same result may be had by giving a brief exposure for the lights, say three or four seconds, and a flash, consisting of about 15 to 30 grains of a good flashpowder, care being taken that the flash is far enough away from the subject to give a diffused lighting and not enough flashpowder employed to overpower the natural light and cast shadows in the opposite direction.

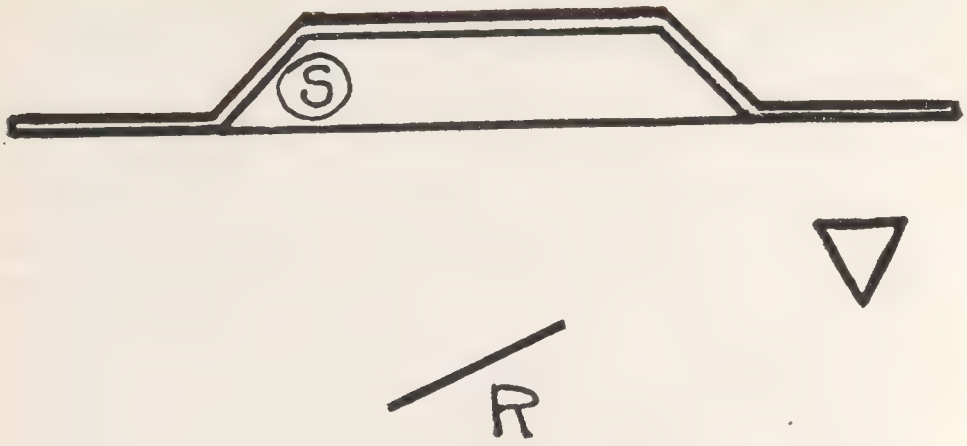
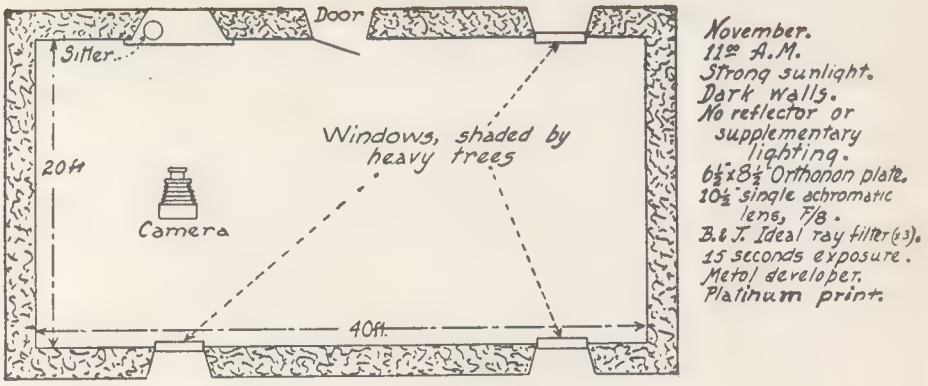


Fig. 13

To make the entire exposure by natural light is, however, preferable, if at all possible.

In the same issue, H. M. Long recommends the following procedure with bromide. The arrangement is similar to that shown in Fig. 14, and the exposure is timed for the deepest shadows, using a reflector at such an angle that it shall throw light upon the deepest-shaded part of the figure. Immerse the plate in 10 per cent. solution of potassium bromide for several minutes, drain, and put into the developer. Method No. 1 is to use the ordinary tube or package developers, for instance, M.-Q. tubes, dissolving the contents in three times the amount of water called for by the label. Method No. 2 is for those who use a three-solution developer, such as the Seed or the Cramer *A B C* pyro or the Central three-solution pyro-metol. In all of these the sodium carbonate is in a separate solution. Mix the developer with the usual quantities of the reducer and of sodium sulphite, but add only *1 drop to the ounce* of the carbonate solution—just enough to open the pores of the gelatine and allow the reducer to act.



Arrangement for Window Portraiture

Fig. 14

A similar restrainer which acts in thirty seconds is:

Copper sulphate	10 grains
Potassium persulphate	20 grains
Nitric acid	50 minims
Water	40 ounces

The film should be rinsed under the faucet after using this formula. Use a strong developer, and do not develop too long.

Portraiture in a Small Room.—In Figs. 15, 15A, and 15B are illustrated the sorts of small room one often finds, with the window so near one of the end walls that the positions of sitter and camera are restricted to those shown in the diagram, or something similar. In this case, however, with reasonably light colors of wallpaper, there is seldom need of a reflector.

Portraits Outdoors.—When one attempts to make portraits outside of the house, the ordinary snapshot methods often suffice, but if a more formal pose is desired, a corner formed between the main portion of the house and an ell is most suitable. Generally a background will be needed. Two arrangements are suggested in Figs. 16 and 17, the choice depending on the direction from which

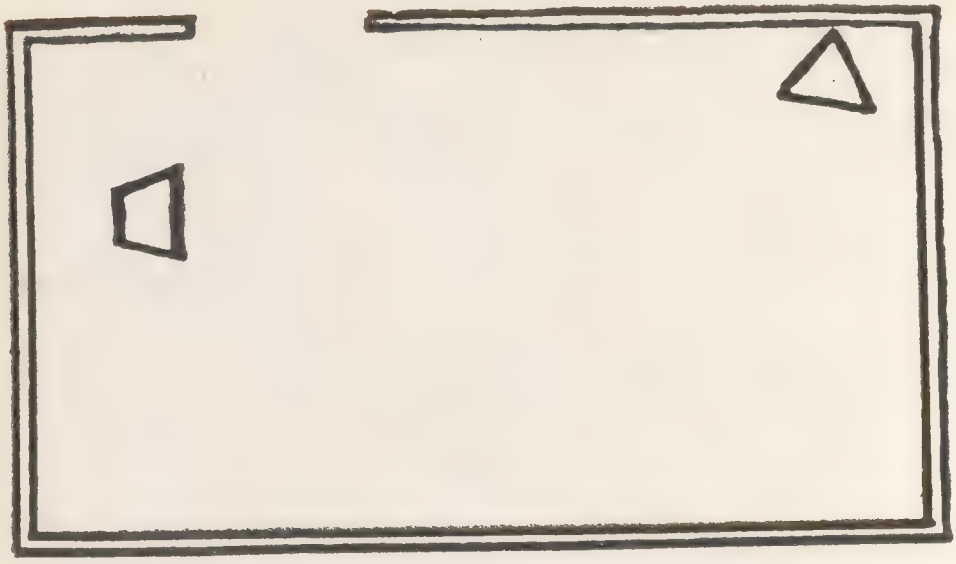


Fig. 15

the light is coming. In the shade, with good sunlight elsewhere, it will usually be found that a

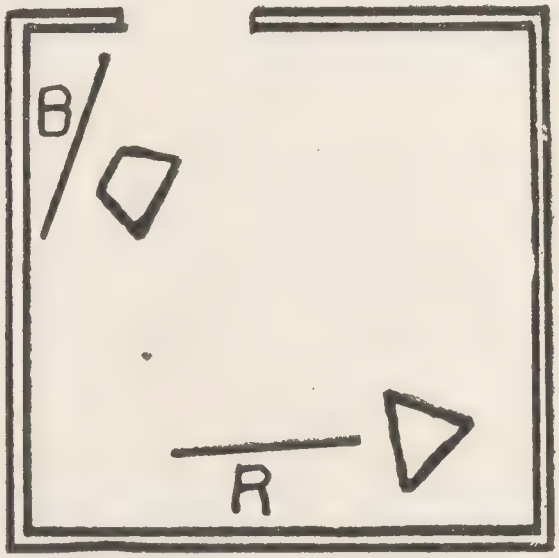


Fig. 15A

position close to the wall of the house gives a lighting free from the objectionable flatness of most

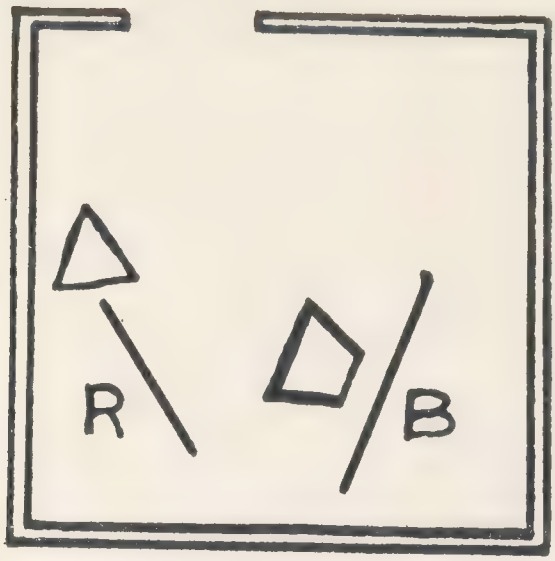


Fig. 15B

outdoor illumination of the face. There is, of course, no reason why the home portraitist should not be able to use direct sunlight on the face if the model can refrain from squinting, and double-coated ortho plates are used; but most pictures of people in sunlight are too harsh and unpleasant to be attempted without a thorough understanding of the problems involved.

Garden Work.—If a suitable background—one free from spottiness—can be found in a garden, very characteristic and interesting portrait studies can often be made, though the method is perhaps more suitable for groups and for genre studies of children than for formal portraiture of the single figure. The greatest difficulty is to secure enough relief in the lighting of the face. An opaque screen suspended at one side in any convenient manner will wonderfully improve the effect by subduing the illumination on that side. There are, of course, certain spots in almost every garden which either very early or very late in the day, when the sun is

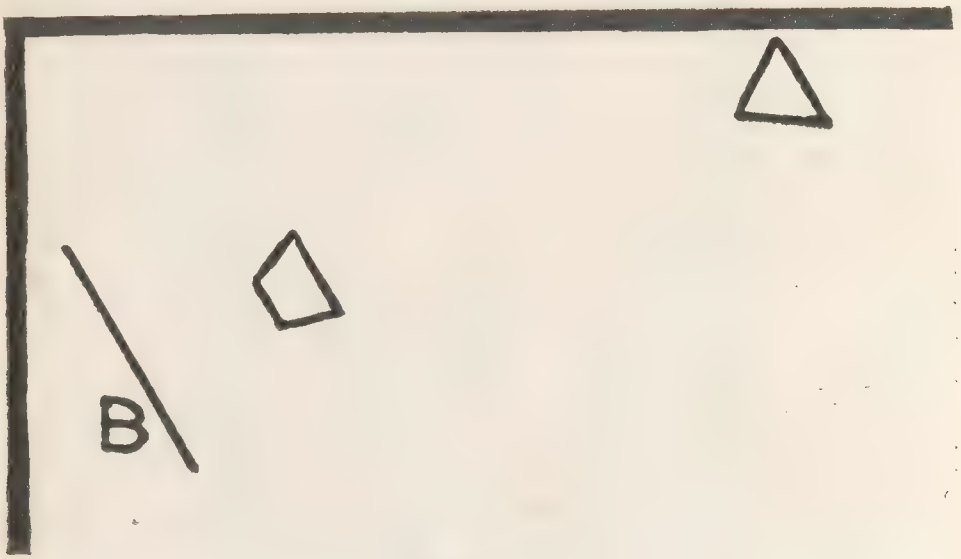


Fig. 16

low, will furnish without the use of any accessories an almost perfect light on the face. In general, the home portraitist will find that when a garden lighting looks right it will photograph attractively, if overtime is avoided.

Technical Points. The Height of the Lens.— Having very briefly pointed out some of the arrangements possible with daylight illumination, let us now take up in detail the many little things which make all the difference between success and failure in portraiture. The height of the lens has already been mentioned. If it is higher than the mouth, too much prominence will be given to the upper portion of the head, at the expense of the chin. The neck will also be unduly shortened and the shoulders will have a hunched-up appearance. If the lens is too low, the under side of the nose will be shown, with the aperture of the nostril looking much more prominent than it is in reality. On the other hand, the lens may be brought to the level of the chest for a standing full-length figure;

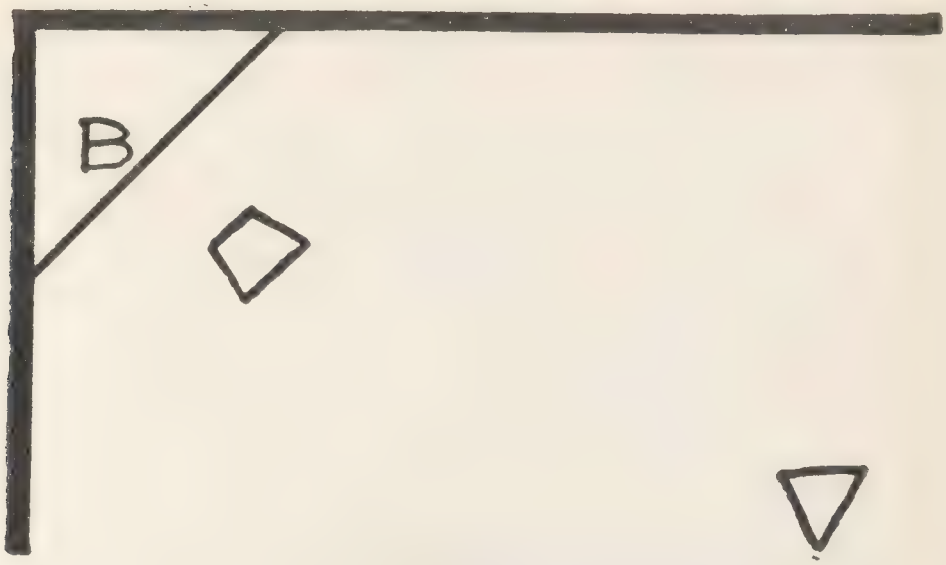


Fig. 17

and if the subject is very low, as a child playing on the floor, the camera must be brought down so that it is about opposite the middle of the sitter. It is here that the reflex type of instrument shows its greatest convenience.

Poise of the Head.—When settling the pose, direct the sitter to look at some object beyond the camera and at such a height that the head is neither inclined too low nor "tossed" in the air, for any deviation from the normal carriage is sure to look exaggerated. As a general rule, with the lens at the height of the mouth, an object on a level with the sitter's eyes should be chosen for the "eye-rest," as it is technically called. If the head is tipped down, the length of the nose is increased and mouth and chin are reduced in size: if the head is thrown back, the nose is shortened and mouth and chin enlarged. Similarly, the head should not be allowed to sag to one side, unless one desires to depict the sitter as if falling asleep; nor should the chin be thrust forward and the head drawn back to

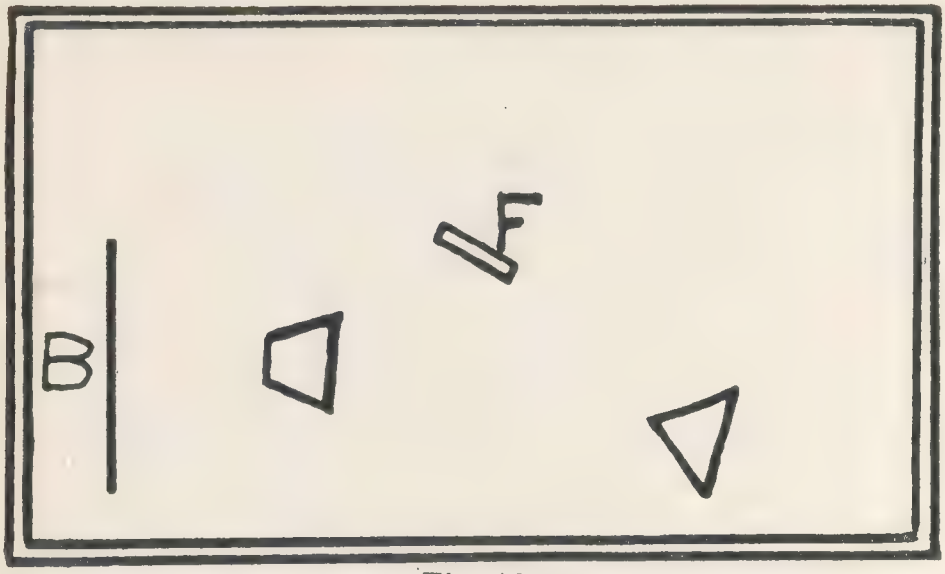


Fig. 18

suggest aggressiveness without great care not to overdo the matter and get distortion.

Effect of Depth of Background.—A light-colored ground makes every tone in the subject seem darker by contrast than in the case of the same subject against a dark ground. It may be stated as a rule that the ground should not contrast too sharply with the outline of the sitter. The outline of the figure may with benefit be allowed to blend into the background. This is what the painters call "lost edge," and gives an atmospheric quality to the print. Dark grounds are most effective for men; medium ones for ladies in most costumes, particularly morning gowns and negligées of a soft, clinging character; light, almost white ones, for very light costumes and ladies and children dressed in white. The dark ground gives more importance to the head. It should not be used with very light clothes, as it is likely to bring out the costume too strongly at the expense of the face.

Use of the Reflector.—The diagrams must not

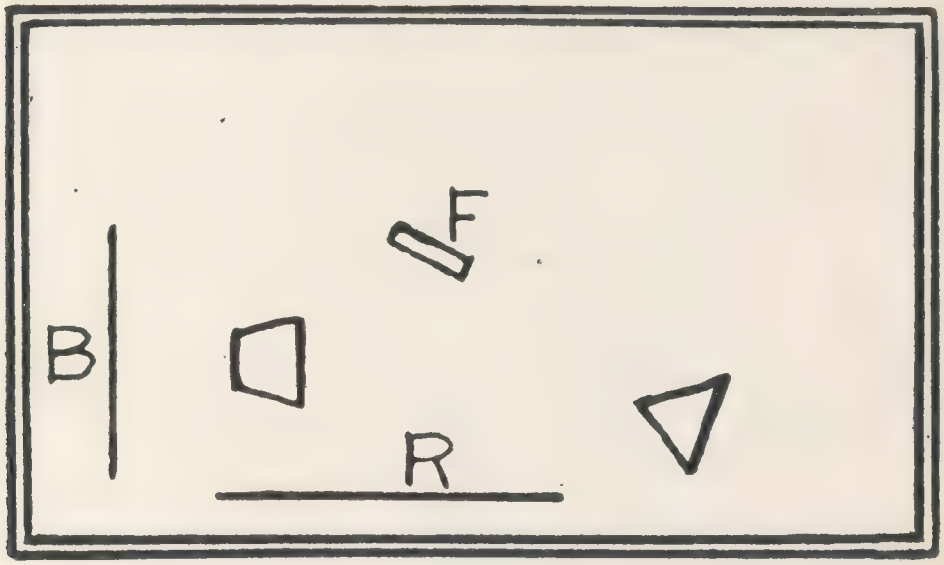


Fig. 19

be slavishly followed. In every case it is necessary to move the reflector around until it brightens up the shadows enough and not too much. Keep it in front of the sitter so that it will be a part of the main lighting. In an emergency, a sheet thrown over a step-ladder or a chair is better than one hung on a wall, because it can be moved around. The physical law at the bottom of the matter is: The angle of reflection is equal to the angle of incidence, that is, if the light from window to reflector falls at an angle of 20 degrees it will reflect to the sitter at the same angle.

Top Lighting.—Whenever an ordinary window is used for a bust portrait, unless the lower part is covered with an opaque cloth as high as the top of the sitter's head, the illumination will be too strong on the lower part of the figure. The light must fall from an angle of 45 degrees. When it is correct, the shadow of the nose will come about half way down the upper lip. If it comes lower, pin the cloth a little lower down; if not so low, a little

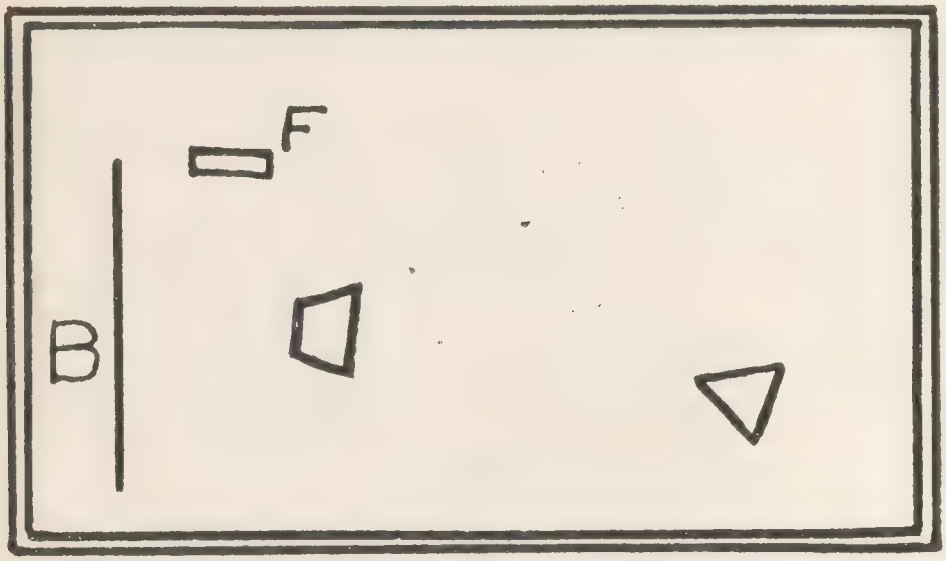


Fig. 20

higher up. Similar principles apply to outdoor lightings, making it necessary to cut off as much light as possible from one side in order to get some effect of shadow.

FLASHLIGHT PORTRAITURE

Taking portraits by flashlight has one great advantage over the daylight method because the intensity and direction of the lighting can be absolutely controlled by the operator. The failures are due to insufficient diffusion of the light. The apparatus needed is such as can readily be improvised, in most cases the use of the flash in sheet, cartridge, or powder form, together with a flashlamp for the latter, and a piece of cheesecloth to diffuse the light. Simple lamps, such as the Agfa, the Caywood, the Spredlite, and others are sold by all dealers. Some use cartridges; others, loose powder. More elaborate lamps with telescopic stands are sold at greater prices. Among them

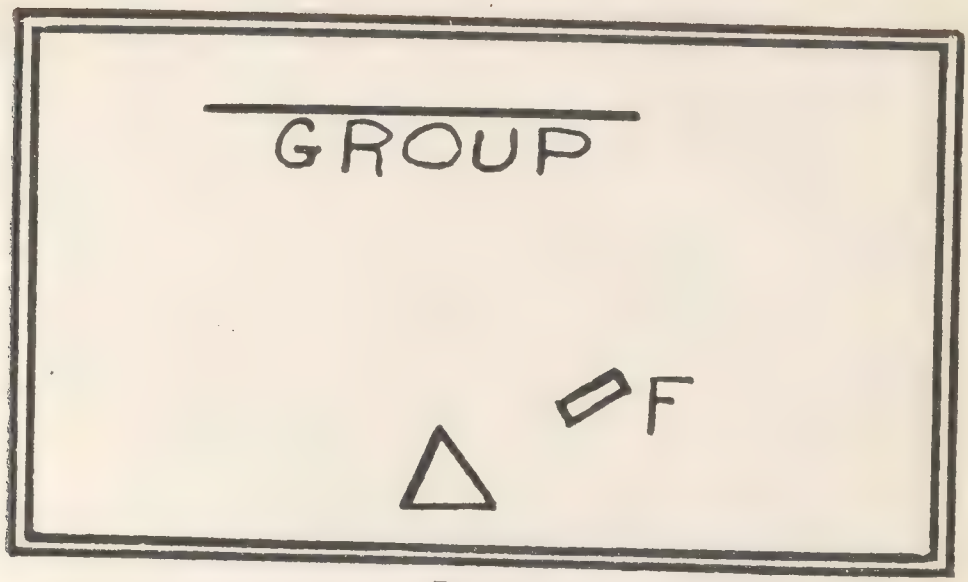


Fig. 21

we may mention the Nichols, which gives a large area of flash. Whichever style is used, the reader will find many useful hints in the free booklet, "By Flashlight," obtainable at Eastman shops, and in the 25-cent book, "How to Make Good Pictures," also published by the Eastman Kodak Company.

The Principles.—To get a good flashlight illumination, the flash must be set off above, to the front, and to one side of the subject's head. The light must fall from an angle of 45 degrees and cast the shadows in about the way already indicated in daylight work. The best way to find the position for the lamp is to take a candle, in a darkened room, and hold it at different points until the effect is right. The nose shadow must come about to the middle of the lip and the light must cross the bridge of the nose and fall on the cheekbone. In small rooms of light coloring, reflectors may not be needed, but in most instances they should be employed about as in daylight work. In addition, it is almost always necessary to diffuse the light by

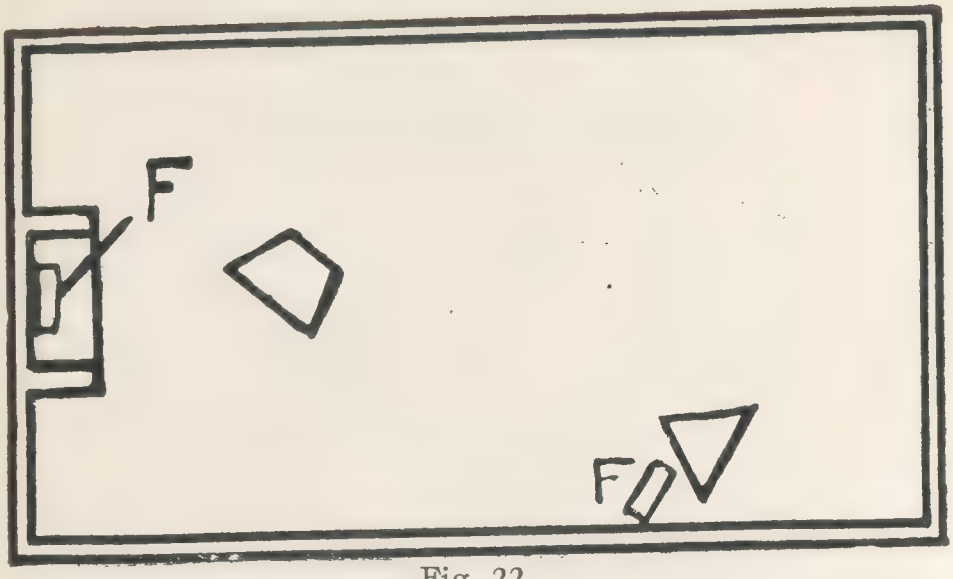


Fig. 22

hanging in front of it a piece of fireproofed cheesecloth. The following recipe is taken from *American Photography*.

Soak the cloth in the following mixture at 86 degrees Fahrenheit.

Ammonium sulphate	8 parts
Ammonium carbonate	2.5 parts
Borax	2 parts
Boracic acid	3 parts
Starch	2 parts
Water	100 parts

Dry, and iron with a moderately hot flatiron.

The Reflector.—To avoid harsh results not only is the diffusing screen necessary, but also a reflector behind the flash itself, as well as a reflector to throw light into the shadows, just as in daylight work. The most convenient reflector behind the flash is a sheet of white mounting card, for it is seldom difficult to arrange an extra tripod to hold a wooden base to carry the card, the lamp, and the diffusing screen, or to improvise a proper support

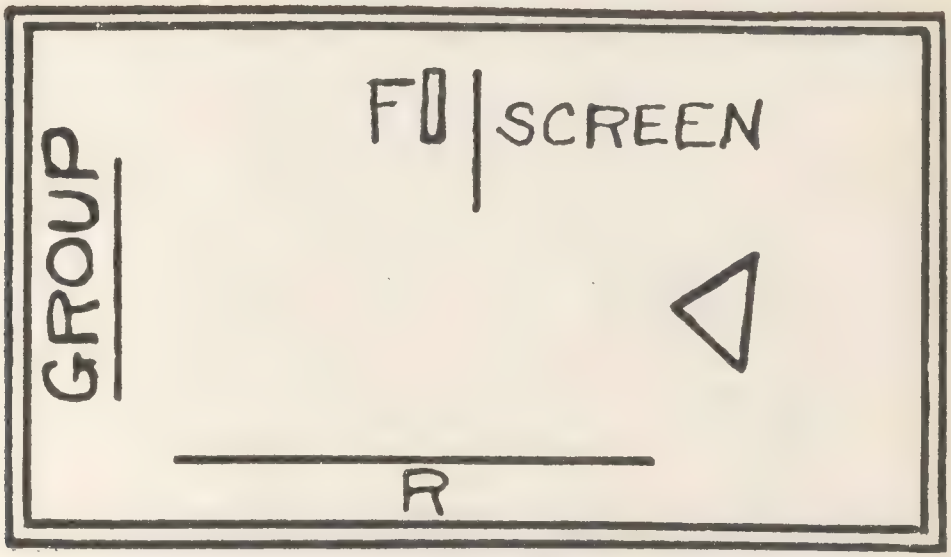


Fig. 23

on the household stepladder. Most of the failures in amateur flashlight work are due to the neglect to provide the accessories.

Flash Sheets.—The Eastman flash sheets give a time flash. Used with the holder, they are similar in effect to a "blow" flashlamp for pure magnesium powder, such as the Prosch and the Folmer and Schwing Crown lamps. They can be pinned up almost anywhere away from inflammable hangings and give excellent results if the sitters are warned that it is to be a time exposure. In any case, do not let the subjects look at the flash.

A Smokeless Flash.—By mixing pure powdered magnesium with an equal volume of guncotton smokeless powder, such as DuPont's shotgun smokeless, an excellent smokeless time flash can be made. Fire it on a tin plate, preferably in a long train on a tuft of absorbent cotton pulled out thin. A dozen exposures of about three drams bulk of each of the ingredients may be made in quick succession without injuring the negatives by smoke in the

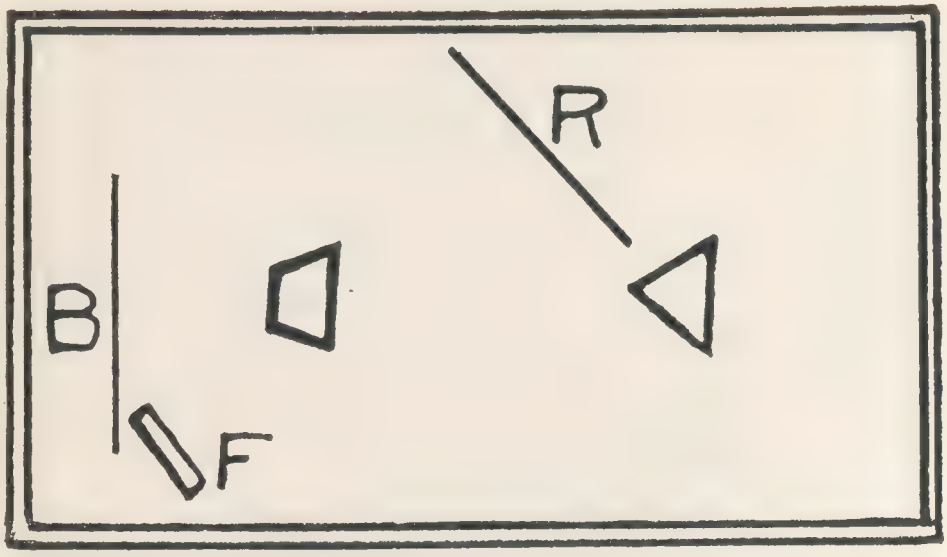


Fig. 24

room. The heat generated is very intense, and the residue remains on the tin plate instead of passing into the air as smoke.

Flashlight Lightings.—Fig. 18 shows the arrangement for a simple broad lighting effect in a small room, *F* indicating the flashlamp, which should be about two feet in front of, two feet to the side, and three feet above the head of the sitter. Fig. 19 indicates about the same effect with the addition of a reflector, *R*. In Fig. 20 we have the arrangement for a Rembrandt effect, the lamp being placed somewhat behind the sitter, so that the face is thrown into shadow. By varying the position of the subject's head and body with reference to the camera, almost any modification, from a line light along the profile to a complete shadow effect, can be made, the exact effect, in each case, being worked out in advance with a candle in the darkened room. When making the actual exposure, however, take care to have all the lights burning, as long as they do not come within the field of the lens, as a

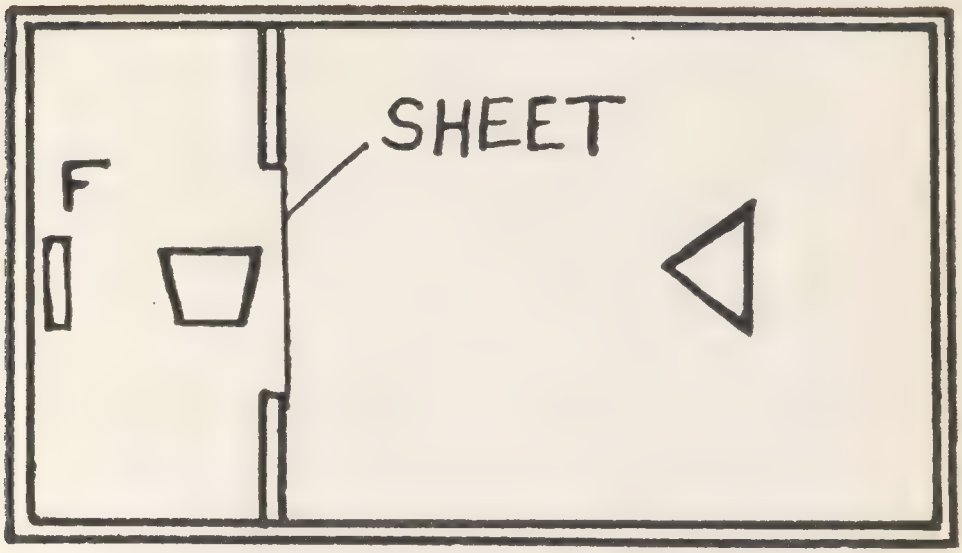


Fig. 25

flash made in a lighted room does not affect the eyes of the sitter and cause staring effects (except in the case of a time flash).

Making the Exposure.—After the pose, arrangement of lamp and accessories, and the other details have been settled, measure the distance from lens to eye of sitter with a tapemeasure and adjust the focus accordingly, or get an assistant to hold a match or a candle about in the plane of the nearer eye and focus the flame sharply on the ground glass. While making the final preparations, keep up a running fire of talk in order to keep the subject from knowing just when the flash is to occur. Having set the lens at its largest aperture and the shutter on time, see that a new film is in position or the plateholder slide withdrawn and grasp the bulb, preferably with the hand held where the sitter cannot see it. Release the shutter and immediately afterwards ignite the flash. The more elaborate lamps, such as the Nichols, are provided with a long tube and a by-pass, so that

one pressure first opens the shutter and then sets off the powder.

Other Lightings.—Fig. 21 suggests an arrangement for a small group, the lamp being put as near the sitters as possible without appearing in the picture. The most important point here is to get the light high, so that the direction will be 45 degrees, as already noted. Most failures in group work are caused by having the lamp too low. A lamp with a folding metal stand extensible to a good height is almost a necessity if much group work is undertaken. Fig. 22 is a firelight effect, the flash being put into the fireplace far enough back to be out of sight of the lens. A second (smaller) flash is employed close to the camera to throw some light into the shadows cast by the main flash and thus avoid the excessively harsh contrasts usually seen in work of this character. Fig. 23 illustrates a method of taking a group when the camera has to be at a distance from the sitters, the flash in this case being put considerably ahead of the lens and shielded by a large opaque screen which at the same time acts as a reflector. In Fig. 24 is a suggestion for another form of Rembrandt lighting, with reflector. Finally, in Fig. 25 is shown a method of making silhouette portraits. The sitter is placed in another room with the flash directly behind and a sheet is stretched without wrinkles over the doorway. It is evident that a soft image without detail will be projected on the sheet. If a sharp image is wanted, the sitter must be posed on the other side of the sheet, that is, in the same room with the camera.

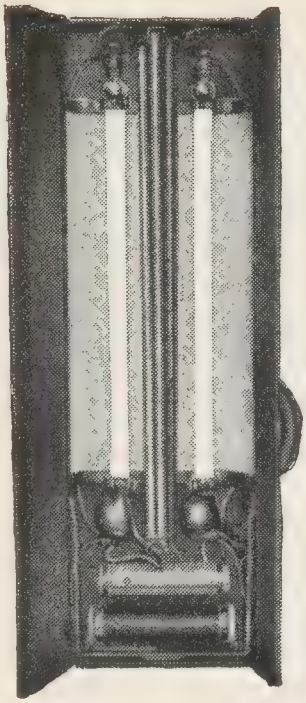
Amount of Powder Needed.—Full directions come with each package of compound flashpowder, some taking as little as three grains for a bust portrait with a lens working at *f*:5. The amount, of course, must be doubled for each size smaller

stop. Thus, with an *f*:8 rectilinear, twice as much powder would be needed as for the *f*:5 lens, provided the distance from flash to sitter were not altered. If the flash is farther from the sitter, the amount of powder needed increases not directly, but as the *square* of the distance. Thus, if 5 grains is enough at 4 feet, on moving the flash to 8 feet, *i.e.*, double the distance, the charge would have to be 4 x 5, or 20 grains. The variations needed for different rooms are tabulated in an article by J. G. Boyd in the June, 1912, issue of *American Photography*, as follows:

Color of Ceiling	Color of Walls	Reflecting Value
Very light	Very light	100
Very light	Medium	75
Medium	Medium	60
Very light	Very dark	50
Medium	Very dark	35
Very dark	Very dark	20

From this table it is evident that the powder charge must be increased according to the color of the room decorations, a room with medium ceiling and very dark walls requiring 65 per cent. more powder than one done all in white. A few experimental exposures will quickly put the reader on the right track.

Portraiture by Artificial Light.—Until recently, only permanent studios could use any form of artificial light except the flash; but recently there has been placed on the market a special Cooper Hewitt outfit for home portraiture. This portable outfit is illustrated herewith. It consists of two 20-inch Cooper Hewitt tubes mounted in an aluminum case with tripod and flexible wire for connecting to the electric supply. The outfit folds up into a case about the size of a suitcase and weighs less than 50 pounds; both direct and alternating current types



The Portable Cooper Hewitt Outfit

are supplied. One user says: "I employ it mostly in conjunction with insufficient daylight, as cloudy weather, or in rooms poorly lighted. I have made a successful 8 x 10 group of a mother and two children at 4 p.m. on a rainy day in December. I gave 2 seconds at *f*:8. I have also done excellent work by the lamp alone, shutting out such daylight as I could with the ordinary shades on four windows."

This outfit would seem to open up a new field for the home portrait worker, as the cost is not great, the current consumption is small, and the exposures are short, particularly if color-sensitive plates or films are employed. It is free from the smoke nuisance of compound flashpowders and should make the operator independent of daylight under bad lighting conditions.

R. D. Gray, of Ridgewood, N.J., manufactures a "Studio Parallax" lamp consisting of a 40-mirror reflector using a large Mazda bulb. It is stated that exposures of about two seconds on ortho or iso plates give full-timed results. The mirrors are so calculated and arranged as to give a diffused light.

Flashbags.—Most makers supply flashbags for confining the smoke of the compound flashpowders and at the same time diffusing the light, thus avoiding the tendency of flashlight illumination to give harsh effects. These bags are particularly desirable for large groups, as at banquets. *The Photo-Miniature*, No. 85, gives the following directions for making a flashbag.

"The Eagle Flashbag consists of a rectangular envelope of close-woven, fireproofed unbleached sheeting, suspended on four cross rods attached to a vertical standard, and having on top a folding flap of peculiar construction which expands with the released gas, smoke, and magnesium oxide and automatically acts as a cut-off from the rest of the

bag. After exposure, the bag and the lamp can be removed bodily from the scene of operations, the smoke and other products having been completely trapped. The whole apparatus, if neatly made, should be extremely portable and fold up into a small compass.

"To construct such a bag, provide a wooden or a metal standard from four to six feet high, or any desired length. To the top of it affix an inverted juvenile wooden top, in which bore four holes for the reception of the metal cross rods. These rods support the flexible bag, which should be weighted with lead sinkers weighing four or five ounces each to keep it in position. The dimensions of the bag should, of course, be chosen according to the size of the lamp with which it is to be used. For the Eagle lamp (George Murphy, Inc.) they should be 5 feet wide, 6 feet deep, and 3 feet high, the top fold measuring 2½ feet. For the Nichols lamp they should be 4 feet wide, 3 feet deep, and 5 feet high, the top fold measuring 2½ feet. The width of the flashbag should always be 2 feet more than that of of the tray of the lamp. For magnesium lamps the bag should have a closed bottom with an opening in the back about one foot from the bottom, large enough to allow the lamp to be inserted and held therein during the exposure." Care should be taken to have the bag sufficiently large for the flame. . . . Not more than half an ounce of powder should be used. Wash the bag and re-fireproof after about four exposures, or it will get clogged and cut off the light.

Development.—It makes little difference what particular developing agent you use, as any one of them, if properly handled, is capable of yielding a perfect negative. In expert hands, pyro is susceptible of easy adjustment and works hard or soft, according to the number of grains to the ounce of solution. Most amateurs, however, objecting to

the stain which pyro leaves on the film and the fingers, prefer the newer, cleaner working agents. Of these, I have found duratol-hydro very good by reason of its susceptibility to any modification, and its entire freedom from any tendency to fog or stain. As in home portraiture underexposure is more likely to occur than over or even normal exposure, there is considerable advantage in using an extra quantity of water. I suggest my own formula as recommended by the manufacturer of duratol. The method of development is far more important than the actual formula selected.

The chief aim in developing portrait negatives is to secure ample detail in the shadows and a full range of tones. This is not possible when development is unduly hastened. The use of strong solutions means a forcing up of the highlights at the expense of the less exposed shadows, and this, in turn, means harshness, a lack of the very quality most essential in portraiture—gradation. Hence it is necessary to start development in a weak solution, adding as much as three or four times more water than the formula calls for. Unless the plate be considerably overexposed (which is unlikely), the image will, of necessity, appear quite slowly, but this need cause no anxiety. Keep it in a dilute solution until the detail begins to show in the shadows, when it is safe to transfer it to, say, a half-strength developer. In this the chances are that ample density will be secured; if not, a few moments in a full-strength solution will give the desired result. In a word, first give your attention to getting all the detail you want in the shadows, holding the plate in check (by the use of dilute solutions) until this point has been reached, then strengthen the image by means of a more concentrated developer. It is best to avoid building up too much density anyhow, or the negative will not hold

up under the printing light as well as its appearance might seem to warrant.

In the No. 6 Handbook of this series there was contributed an article under the title of "Four-Tray Development," and I would suggest that the method therein outlined be applied to the development of portrait negatives.

Printing.—A word as to printing. Never put your frame in the sun unless protected by one or more sheets of white tissue paper. Otherwise print in the shade. There is as much difference between a print made in full sunlight without a protecting tissue, and one made in the shade or with a protecting tissue as there is between day and night. Use the "soft" grades of gaslight papers.

RETOUCHING

Finishing the Negative.—Few portrait negatives, even when taken in a studio, print exactly as one desires without a little handwork. For his first attempts, the amateur had better stick to filling up pinholes or reducing and intensifying, if these processes are needed to improve the printing quality, owing to faulty exposure or development. Later, when one can see the effect and expose to get it, the shortcomings of lenses and plates in exaggerating skin defects will lead one to attempt retouching. The first number of this series, "Retouching for Amateurs," has lately been revised and enlarged, and now forms one of the best guides available.

MISCELLANEOUS POINTERS

Firelight Effects by Daylight.—By posing a sitter on a table in front of a window which has been screened all except about a foot at the bottom and using a rug and fireplace accessories, very good firelight effects may be secured. It is essential to

use opaque screens and to arrange a reflector outside the window at such an angle that the light is thrown up on the face. The background should be managed to represent a living room, if the effect is attempted in a studio.

Lamplight Effects.—Mr. H. Essenhigh Corke suggests in *The Photo-Miniature*, No. 112, the making of a dummy lamp. Take an ordinary lamp into a darkened room and burn about one quarter of an inch of magnesium ribbon directly over the wick, using *f*:8 and a double-coated plate. From this negative, make a bromide enlargement the natural size of the lamp, mount, and cut out. This dummy is stood up so that it appears to be the source of light. Real lamplight pictures can be made on red-sensitive plates with an exposure of only a few seconds.

If panchromatic plates are used with a lens of *f*:4.5, a few seconds' exposure is sufficient with a table lamp, provided the room is well lighted by gaslight or lamplight, and the lamp itself is exposed for about a second and then extinguished.

A Tip on Children.—When taking a child portrait, be careful to keep your own head, if possible, about at the level you wish the child's eyes to look, for if you stand erect the child will look up and the eyes will appear raised too much in the photograph.

APPARATUS

Cameras with Fixed-Focus Lenses.—With the aid of a portrait attachment, even the lowest-priced box camera, such as the Brownie, the Buster Brown, or the Scout may be used for portraiture. The attachment costs 50 cents and slips in front of the regular lens, allowing the camera to be placed three and one half feet from the sitter. The result is a larger image than could be got with the regular lens at the nearest distance—5 or 6 feet—at which it gives a sharp image. As, however, single meniscus

achromatic lenses seldom work at a larger aperture than *f*:16, the lighting must be brilliant so as to avoid excessive exposure and consequent movement of the sitter. Outdoors in the shade, very satisfactory pictures may be made with the equipment mentioned above.

Folding Cameras with Rapid Rectilinear Lenses.—Kodaks and other cameras with only a single extension of the bellows will generally focus objects up to 6 feet, but most workers prefer to add the portrait attachment and work at 3½ feet.

The lens usually fitted works at *f*:8, allowing one to give pretty short exposures.

Double-Extension Cameras.—When the camera has a bellows sufficiently long to allow the use of the rear combination of the lens, a larger head can be made at a greater distance, thus securing improved perspective at the expense of four times' longer exposure. As, however, the longer the focus of the lens employed, the better the drawing, many amateur workers prefer the half to the whole objective.

View Cameras.—On account of its long bellows and large lensboard, the regular professional style of view camera is particularly well adapted to portraiture. It can be used on either a tripod or a light stand. The drop of the front is usually greater than in the case of folding cameras, and the swings can be manipulated by means of rack and pinion without taking one's head from under the focusing cloth. If a camera is to be purchased for home portraiture, a view box is probably the best choice. It is the only style except the regular portrait camera which has a lensboard large enough for long-focus lenses such as the P.&S. Semi-Achromatic or the Wollensak Verito.

Studio Cameras.—Sometimes one can pick up cheaply an old portrait camera and a light stand at a second-hand dealer's. If room is available for

storage of the apparatus when not in use, such an equipment will be found admirable for a permanent home studio.

The Reflecting Camera.—Readers who are fortunate enough to possess a reflex camera will find it ideal for portraiture, owing to the fact that they can work in comfort in brilliant lighting and make snapshots indoors. There are certain limitations, the chief being lack of a swingback (its English substitute, the swing front, is supplied on the most expensive models); lack of falling front, which is, however, partly compensated by the low position in which the camera must be held in order to see the subject on the screen; and the noise made by the shutter. For child portraiture, however, the reflex is the instrument *par excellence*. With a lens working at *f*:4.5 and an exposure of 1-25 to 1-10 second, fully-timed portraits can be made in an ordinary room, provided the child is dressed in light colors and photographed against a light background. Abroad, the reflex principle has been applied to studio cameras, and in this country the Home-Portrait Graflex has been put on the market.

The reflex type is particularly well suited to use the fixed-focus or rather fixed magnification telephoto objectives, such as the Cooke-Telar and the Ross Telecentric. These allow rapid exposures and give the advantage of long focus with better perspective without excessive draw of bellows.

Special Lenses.—If the camera will admit, a second-hand portrait lens of the Petzval type can often be used to advantage; but most amateurs prefer the more compact modern anastigmats. Other things being equal, the greater the speed, the better the lens for home portraits. An *f*:4.5 anastigmat is good, provided the worker does not get it too close to the sitter and thus lose depth and be forced to stop down. An *f*:4.5 lens is twice as fast

as an *f*:6.3. An *f*:6.3 is 61 per cent. faster than *f*:8 lenses. Most so-called *f*:8 lenses must be stopped to about *f*:9 when corner definition is demanded, which makes the *f*:6.3 lenses about twice as fast in practice as rapid rectilinear lenses; and in *f*:4.5 lenses the relation then becomes 4 to 1. The *f*:4.5 man with his short exposures has less plate spoilage by movement, and moreover, the fast lens digs into the shadows and produces shadow detail which does not come out by multiplying exposures by four, as might be assumed to be possible if rapid rectilinear lenses are used. Among the anastigmats which attain this speed are the Eurynar, Euryplan, Heliar, Homocentric, Tessar, and Velostigmat.

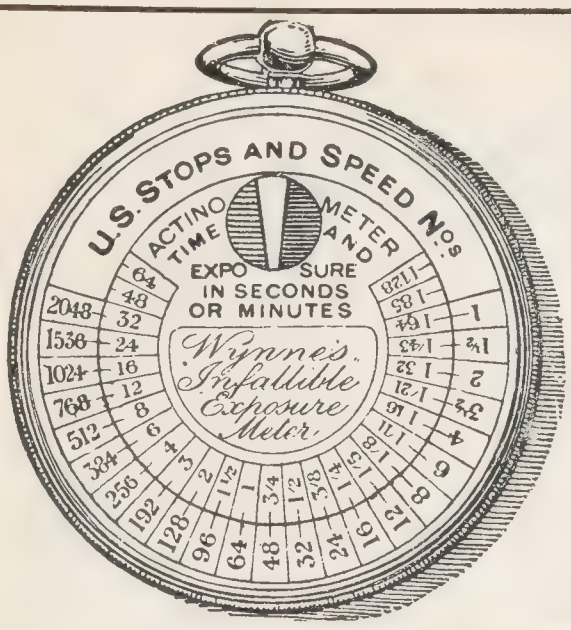
Soft-focus lenses are popular among amateurs of artistic aspirations. The "Smith" (P.&S. Semi-Achromatic) was the original American lens of this type. The single lenses are now supplemented by two series of Semi-Achromatic Doublets, working at *f*:6 and *f*:4.5 respectively. The Spencer Port-Land single lens is a later introduction. The Wollensak Optical Company has also entered the field with its *f*:4 doublet known as the Verito, which is used by some of the leading professionals.

The Spencer Port-Land (meaning Portrait and Landscape) lens is a single view lens of peculiar type. It differs from all similar lenses in having the enormous rapidity of *f*:4.5; but can seldom be used wide open except in a dull light, because the spherical aberration is so great that a number of overlapping images is produced. When the stop is reduced to about *f*:5, however, the quality of the definition is most pleasing. There is a great deal of vibration without the production of a band of halo around the highlights, and the detail is all preserved, but softened and massed together in a peculiar way. In portrait work, the effect of likeness is such as the normal eye sees, for one does not get any such

impression of a person's face as is given by a Petzval portrait lens sharply focused, and the negative unretouched. The rendering of skin texture is good, but there is no magnification of pores, hairs, wrinkles, etc. In short, a negative made with a lens of this type is good enough, as a rule, to require no retouching at all—unless a mistake has been made in the lighting. Some of the most artistic and at the same time most practical amateurs use a Spencer lens on a reflecting camera for practically all their work, and their portraits are highly praised by painters and advanced professional photographers.

Supplementary Lenses.—The best-known form of supplementary lens is the Kodak Portrait Attachment. In the absence of one of these fifty-cent accessories, the amateur can utilize spectacle lenses. The simplest and easiest rule is: "To bring close objects into focus, fix before the lens a thin lens of focal length equal to the distance of the object. Thus for objects 2 feet away a lens of 24 in. focal length."—From *The Lens*, by Bolas and Brown. For small lenses, the trial glasses from an optical test case can be used.

Spectacle Lenses.—Double convex spectacle lenses give fair definition over a small area and are capable of making very good portraits if a long focus is chosen. A stop should be placed in front of the lens a distance equal to 1-5 of the focal length. The meniscus spectacle lens, having one side concave and the other convex, is more generally useful. Used with full aperture with the concave side towards the sitter, it gives good definition. After focusing, both forms must be moved towards the plate a distance equal to 1-40 of the focal length of the lens, or even more, when working close to the subject. If, however, a yellow ray-filter and an iso plate are used and the image is focused with the filter in place, no correction of focus is needed.



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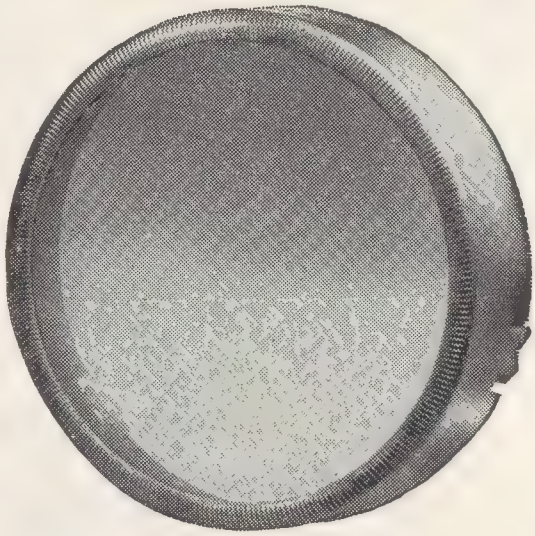

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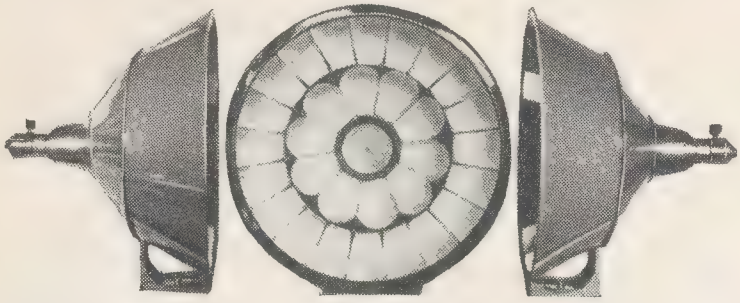

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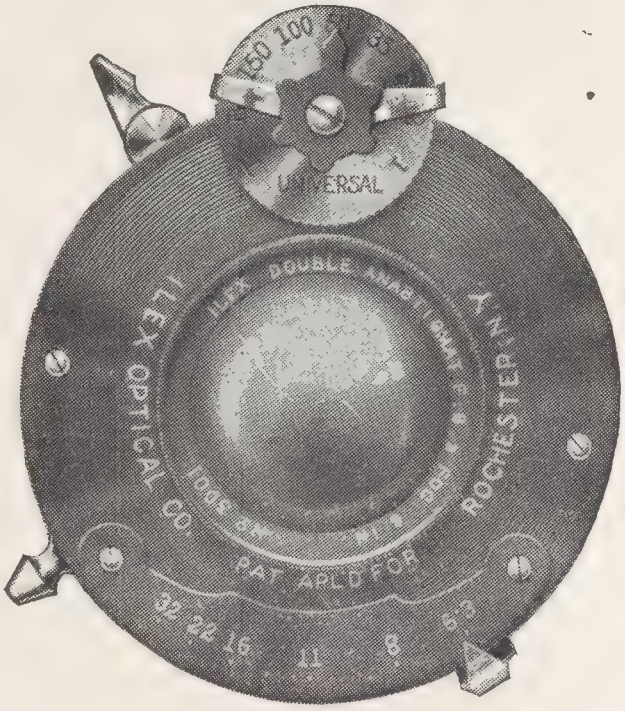

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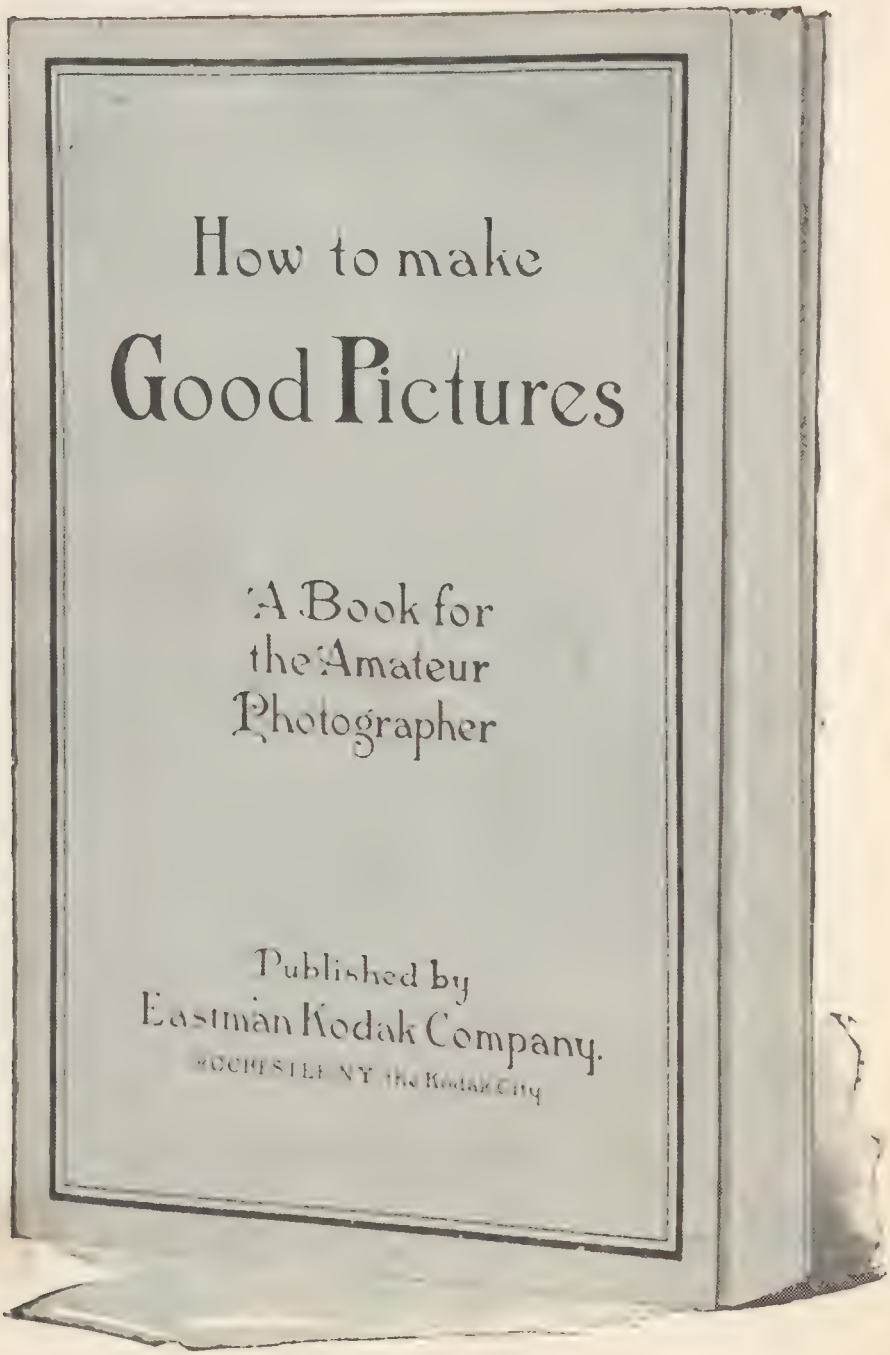
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